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MERAMEC REGIONAL SOLID WASTE MANAGEMENT STUDY

Meramec Regional Planning Commission

Prepared for:

Environmental Protection Agency

July 1974

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REGIONAL SOLID WASTE MANAGEMENT STUDY

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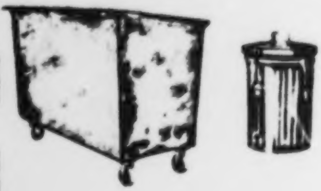

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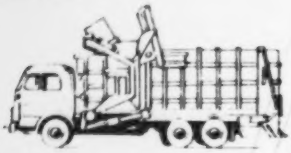

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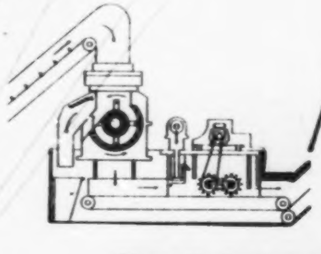

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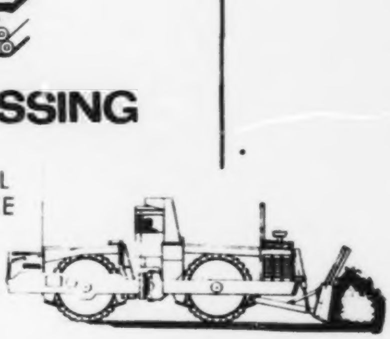

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This report contains the basic elements of an analysis and recommendations for the solid waste management system within the Meramec Region. Basic data includes an inventory of the study area with reference to the solid waste management system, along with the framework for practical solid waste management systems. Recommended solid waste management improvements and cost analyses are listed by county within the Region.

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MERAMEC REGIONAL PLANNING COMMISSION

HAROLD F. BRAY, EXECUTIVE DIRECTOR

1203 E. 10TH STREET • ROLLA, MO. 65401 • 314-364-2993

July 31, 1974

Donald Townley, Director
Solid Waste Management Branch
Environmental Protection Agency
Region VII
1735 Baltimore Avenue - Room 249
Kansas City, Missouri 64108

Dear Mr. Townley:

Enclosed is a copy of the recently completed Meramec Regional Solid Waste Management Study. This planning report is rather unique in that it combines five separate plans that provide for the needs of 28 units of local government.

The plan establishes a method to satisfy the needs of the region's people, and the State Law pertaining to the collection and storage of solid waste.

The local units of government have or are forming Landfill Boards to provide management and to implement the plan that applies to them.

The Meramec Regional Planning Commissioners are grateful to the Environmental Protection Agency for its financial support in the preparation of this report.

Sincerely,

Harold F. Bray

Harold F. Bray
Director, MRPC

HFB/bh

ACKNOWLEDGMENTS

Over the past two years many public agencies and private individuals have offered much valuable assistance in the preparation of this report. To all these persons we wish to express our gratitude for without their efforts the progress which has been made in the field of solid waste management would not have been possible. We wish to particularly thank the staffs of the U.S. Environmental Protection Agency, the Missouri Division of Health and the University of Missouri Extension Service for their excellent and much needed assistance.

IN MEMORIAL

We wish to make special recognition of the many hours of assistance given by the late Edwin E. Lutzen with the Missouri Geological Survey who served as Chairman of the Meramec Solid Waste Technical Advisory Committee. Through his efforts we gained much insight in developing a practical plan to ensure protection of the environment.

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Reasons for Change

Missouri Legislation-- Until 1972, Missouri had no legislation regulating solid waste collection and disposal. Under the County Option Dumping Ground Law, counties had the option of regulating disposal facilities. However, Phelps County was the only county in the Meramec Region to choose this option.

With the State Solid Waste Management Act (Sec. 260.200 through 260.245 RSMo) Missouri, like all eight surrounding states, now has a solid waste control law. The legislation not only provides for solid waste system regulations, but also requires every city and county to adopt and implement a solid waste management plan. Presently, all solid waste processing or disposal facilities are required to have a permit from the Division of Health. To keep this permit, the facility must be operated to meet state regulations which include operating according to an engineer's plan.

City and County plans must include the type of refuse service proposed, the area which will be served, and a time schedule for providing the service. It is also required that some form of refuse service be provided to every resident in the cities. The Attorney General's Opinion No. 42 further clarifies the Solid Waste Management Act. His Opinion states that refuse service must be provided to a commercial and industrial establishment the same as a residence. This Opinion also states that the city or county is responsible to collect the fee for refuse service.

In the cities with utilities this will not cause great problems because the cost of a refuse service charge can be included on the utility bill. If a person refuses to pay the refuse service charge the other utility services can be discontinued. The cities in the region which have adopted this system report minimum problems.

Counties and small towns without utilities can assess a 10¢ per $100 assessed evaluation tax for solid waste management if it is approved by a majority of the voters. They can also assess a service charge for refuse service without approval of the voters. However, the only method available to the counties of collecting delinquent service charges is court action.

Growing Problem-- One reason for this law is that the amount of trash that people are throwing away is increasing at an alarming rate. Figure 11 indicates that if refuse generation in the Region continues at the rate it has, in 25 years people will be throwing away 2.5 times as much trash as they are today.

It used to be no problem for a farmer to use the trash he had as ditch filler. However, with the increasing use of pesticides and other chemicals, this can prove to be dangerous. There is also an increasing number of people moving into unincorporated areas that don't live on farms. Table indicates that in 1970 68% of the households in the unincorporated areas of the region were not on farms. It is already evident that as cities adopt uniform collection and close the gates to the city dump, the people on small lots in the county will be forced to either dump their trash along the roadside or on someone else's property unless some system is provided.

Health Problems-- The possibility that refuse found in a dump is a direct cause of disease in a community cannot be proven, but an important relationship between disease and the existence of such an area of concentration of garbage, does exist. Rats, flies, mosquitos, and various other pests are known to carry disease causing germs. Anyone who has visited a dump in the summer has seen swarms of flies and mosquitos, while a trip after dark usually reveals a frighening number of rats. A dump is a very attractive place for these vectors because it provides food, shelter, and comparative safety from extermination attempts. Sometimes, it is assumed that burning at a dump will decrease the food sources, but actually it is mainly non-edible waste such as paper, which is burned, while the moist food wastes are merely cooked. A survey of the dumps in the region indicate greater numbers of rats at the dumps where open burning is practiced than where it is not.

Some of the diseases which are carried by rats, flies and mosquitos are poliomyelitis, typhoid fever, tuberculois, trachoma, tapeworms, tularemia, rat-bite fever, and Rocky Mountain Spotted Fever. A total of 51 diseases which are spread by the carriers have been found, and additional study would probably add to the list.

Obviously, the germs from these diseases are not normally found in refuse. This explains why serious epidemics have not occured in every community which has a dump. However, the presence of large number of vectors is a constant threat to all nearby communities. Animals such as squirrels can carry many of the diseases mentioned into an area. These diseases can quickly infect the entire rat population at a dump. With this reservoir many of the diseases mentioned can be spread to humans by people coming to the dump, flies, mosquitos, or by sick rats losing their natural fear of man and leaving the dump.

It is an interesting fact that the common house fly has been known to travel over 20 miles. Even though it probably isn't carrying a disease, it's not a pleasant thought to the picnicker at Meramec Springs that the fly walking on his sandwich could have been hatched in garbage at either the Cuba, Leasburg, Newburg, St. James, Salem or Steelville city dumps.

Water Pollution-- Runoff from dumps can cause both surface and ground water pollution problems. Geologists warn that in this area of the Ozarks what is thrown on top of the ground has a good chance of ending up in someones water supply. Besides the dangers of pesticides and other chemicals, the natural decaying of refuse can produce very toxic runoff called leachate. Table 1 is a comparison of typical solid waste leachate and domestic sewage. It should be noted that a well operated sanitary landfill will produce no leachate.

TABLE 1 : COMPARISON OF SOLID WASTE LEACHATE AND DOMESTIC SEWAGE

Constituent	Concentration *		
	Leachate	Sewage	Ratio of Leachate to Sewage
Total Suspended Solids	360	200	2
Chemical Oxygen Demand	17,500	500	35
Biochemical Oxygen Demand	10,000	200	50
Total Organic Carbon	6,100	200	31
Alkalinity	3,100	100	31
Acidity	1,400	20	70
Total Phosphorus	22	10	2
Total Nitrogen	250	40	6
Chloride	660	50	13
Iron	55	0.1	500
Manganese	70	0.1	700

* Measured in Milligrams per liter.

Source: "Characteristics of a Sanitary Landfill and Its Potential Effects on Water Quality"

Indirect Cost of Open Dumping-- The true cost of allowing open dumping is impossible to measure because of the many indirect losses resulting from this type of waste disposal. To be useful, a dump must be within reasonable distance of the population center, where the land value would be expected to be higher. However, an open burning, rat infested dump isn't a very pleasant neighbor and naturally the property values in the surrounding area will be considerably lower.

The Missouri State Highway Commission spent over $13,000 in the period from June 1972 to May 1973 in cleaning up litter in the Region. The cost of this comes from Highway Taxes. The county highway departments generally do not perform this function but since most dumping is done on the lesser traveled roads, the cost to the counties would be extremely high if they tried to take the responsibility for this job. One County Court Judge has told of having to get the road grader out to clear a road of trash before the school bus could get through.

The responsibility for cleaning up almost all the promiscuous dumping is passed on to the land owner. It is estimated that in the region over 18,000 tons of trash are burned or dumped annually along the roadsides, on private property or in the rivers. The cost to the land owner of cleaning this up is impossible to estimate. Many serious consequences can and do result from this situation. Broken bottles washed into fields can easily ruin equipment tires. A tractor tire costs at least $90 to replace or $25 just to patch. Broken bottles and cans are more and more becoming familiar sights in streams which provide swimming areas to many residents and to some tourists. There is also the possibility that these objects could be baled in with the hay crop and later eaten by livestock. The death of a cow, for example, would cost a farmer $250 to $400. These are just a few examples of the indirect costs which make the present method of trash disposal much more expensive than it first appears. It shows that in most instances it is the landowner who is picking up the tab for his neighbors poor practices.

Natural Resource Depletion-- In the Meramec Region over 44,000 tons of material are discarded in dumps every year. Of this material 17,000 tons are paper, 4,400 tons are glass, and 4,500 tons are metal. The first step toward reclaiming some of the material and slowing the drain on our natural resources is to establish good solid waste management facilities. As long as the refuse is being scattered all over the country-side there is little hope of a materials or energy reclamation project.

SUMMARY

Method of Conducting the Study

Purpose-- The Solid Waste Management Plan was needed to assist local officials in developing the framework of their own Solid Waste Management System, the burden of which was placed upon them by Missouri legislators. The study was conducted for the purpose of objectively evaluating the solid waste problems in the Meramec Region, developing a practical plan of providing the services the people want and need, then as much as possible, assist with the implementation of the plan.

Whenever possible the Staff of the Planning Commission attempted to serve as advisors to the local officials by developing the necessary information to make sound management decisions. The Mayors and County Court Judges, of course, were in a better position to determine the types of service the people wanted and needed, but, the available alternatives along with engineering estimates of the cost needed to be prepared by the Planning Commission for review by the local officials.

Approach Taken-- One of the first steps taken in conducting the study was the formation of a Technical Advisory Committee composed of experts from interested Federal, State, County, and City agencies as well as representatives from citizen groups. The T.A.C. elected a dedicated Chairman, the late Ed Lutzen, who contributed many hours and ideas to the formation of this plan. Along with providing technical expertise to the study through the T.A.C., invaluable contacts were established.

Initially, consideration was given to each city developing its own collection and disposal system, but it was found that the City of Rolla was the only city large enough to economicly justify establishing an independent disposal site. Consideration was then given to establishing a regional system. The main advantage to this alternative is that, while individual cities could not afford a good professional management system, a regional area could. It was felt, however, that the increased haul distances, lack of legal frame work, and concern of losing local identity, would make establishment of such a system almost impossible. Organization of the management structure on a county basis was found to be the most desirable, although rigidly following the county boundaries as service areas, is not recommended.

Working with county groups of Mayors, Judges, and County Extension Specialists to develop their plans was the next step. Whenever necessary, attempts were made to establish a county solid waste management structure. The next tasks to be performed varied with the requests of the Mayors and Judges. They ranged from developing the cost analyses, to anything necessary to get the system in operation. This section of the report was written by the light of a gas lantern as the author manned his shift at an around-the-clock pumping operation on an abandoned clay pit, which will be used as a sanitary landfill.

Solid Waste Management System Proposals

Development of Design Data-- A review of available published material revealed that design data for rural solid waste management systems is greatly lacking. Literature from solid waste equipment manufacturers was also requested and their data was used in equipment sizing and cost analyses. The most valuable design information came from studies of the existing refuse collection and disposal operations in the region.

Studies of the collection systems revealed a considerable difference in the number of services made per day. In one city with mandatory, twice-per-week, curbside collection, a two-man crew was found to be averaging 1000 stops per day. In another city with voluntary, twice-per-week, curbside collection, a three-man crew averages 350 stops per day. Consistently, it was found that crews of private collectors were serving more stops than municipal crews.

Detailed studies of the time actually spent enroute indicated that for the same level of service and crew size, the average time per stop among all crews were fairly consistant. The difference in the number of stops per day was usually because of the differences in haul distances to the disposal sites, dead-time enroute, length of breaks and work load assigned per crew, with the work load assigned per crew being the most critical feature. It was noticed that in the more efficient systems, the person that assigned the routes always worked the routes, at least occasionally.

After studying all the collection systems in the Region it appears that the factors which determine productivity of a collection system are management, mandatory versus voluntary collection, level of service, then distances to the disposal site. The above are listed in their order of importance.

Data for rural collection systems was not as readily available as for the city systems because there are fewer in operation. Naturally, the most efficient crew and truck size will be different in a rural route than in a city, but most of the rural collection systems are run with the same truck and crew as in the cities. The most productive rural route in operation in the Region is run by a one-man crew using a 10 cu.yd. compactor truck. Larger trucks have problems with manueverability on county roads and low weight limits on bridges. Using a one-man crew in a rural area reduces the man hours lost in travel time between stops. In other words, in most areas, rural collection routes have not been designed, especially for rural collection but adopted from city collection systems. This tends to make rural routes less feasible.

Trends in the average collection times were developed from the studies of the existing collection systems. From the data, projections of manpower and equipment requirements were made as needed for establishing city and rural collection systems. In all projections it was assumed that a good management system would be provided. Likewise, in the cities, it was assumed that a uniform collection ordinance would be passed.

Manpower estimates of servicing an area were made by calculating the time spent on route servicing the stops, then adding the time spent traveling to and from the landfill, on breaks, and on daily maintenance periods. The collection system in the City of St. James was established after the manpower and equipment requirements were calculated for various levels of service. This system has been operating as projected for over a year now.

Although none of the rural collection routes for which projections have been made has actually been established yet, three routes were test driven. The projection assumed 50% participation so the routes were driven with stops made at every other house and sufficient time allowed at each stop for service. The routes were projected to need four hours to run and each route checked-out within ten minutes of the projected time.

Since little published material could be found pertaining to estimating collection service times for rural communities it is hoped that the actual collection times can be checked against the projected time. With this data, improvements in methods of estimating service time can be made.

Solid Waste Service Cost Estimates-- With each routing analysis a cost estimate for service was made. When comparing these cost estimates with actual operating costs, differences were found in individual items in the budget, but the total projected user cost is usually very close to the actual user cost. With the cost of gasoline and equipment increasing at the outlandish rates they have been, it was very difficult to establish a user cost. To allow for inflation, a range as high as 20% should be allowed over the projected user cost.

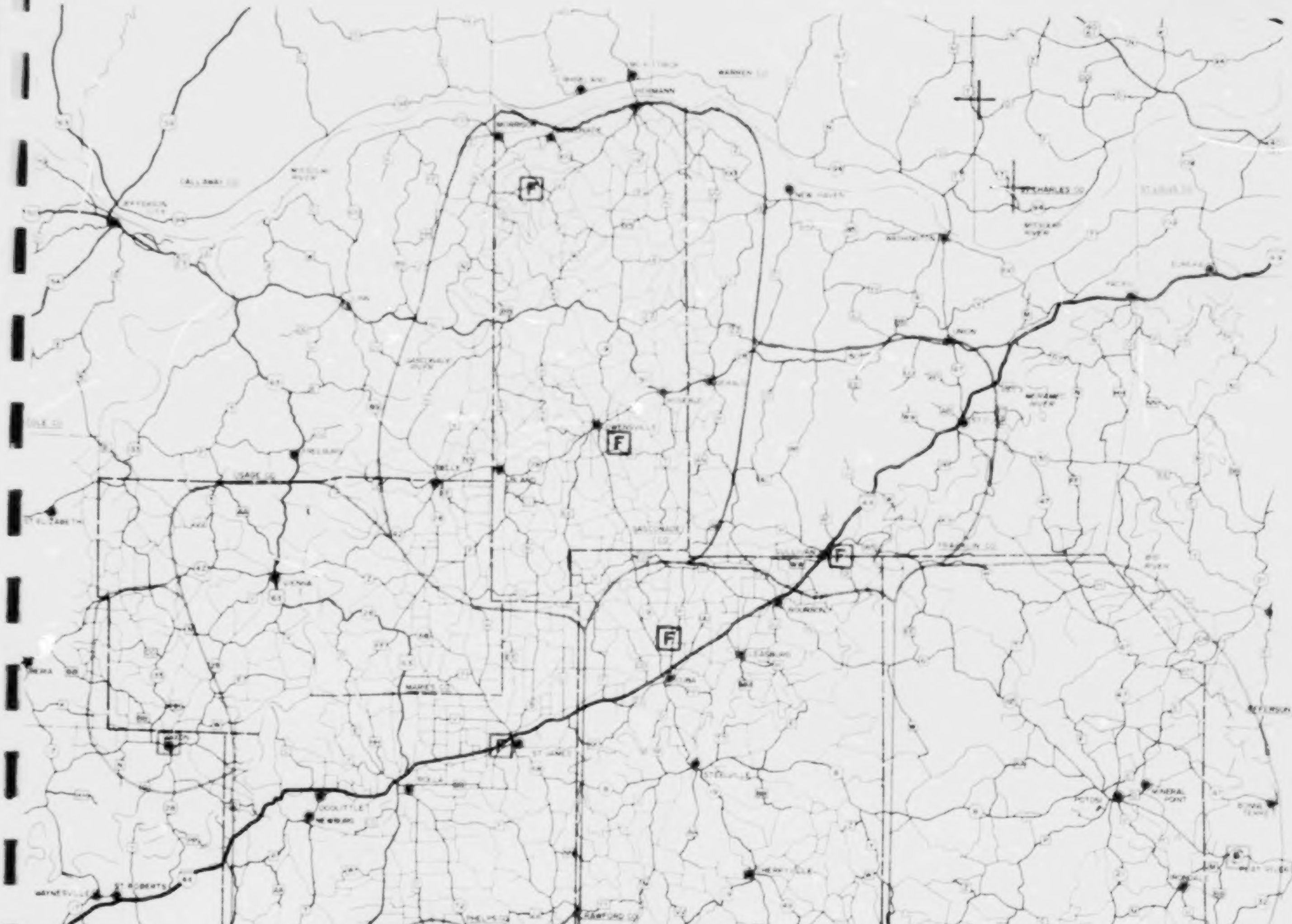
Projected user charges in the cities for once-per-week curbside collection, which includes collection, disposal and administrative cost, could be expected to be between $2.00 and $2.50 per family per month. User charges for a well run twice-per-week curbside collection system could be expected to run between $2.50 to $3.00 per month, and backyard twice-per-week collection could run as high as $3.25 per month. User costs in rural collection systems were found much more inconsistant than city collection systems. This is primarily because of the differences in levels of service, participation rates, and population densities. If county containerized systems are considered, everyone would naturally be expected to pay for service. It is estimated that a centrally located container system could cost as little as $1.00 per family per month. To provide a more convenient system, four to six cubic yard containers can be placed throughout the county, then the user charge would probably run between $1.25 to $1.50 per family per month. Voluntary mailbox collection in the rural areas will naturally depend on the population per road mile and participation rate. Assuming 50% participation, the projected user costs for mailbox collection could be expected to vary between $2.75 to $4.50 per month, depending on the area.

Proposed Service Areas-- Figure 1 shows the locations of the proposed landfills in the area and their approximate service areas.

General Solid Waste Management Recommendations

In addition to the recommendations made in the county plans, the following recommendations, which require State or Federal action, were found necessary.

1. All solid waste management planning efforts for State and Federal facilities in the Region should be coordinated with the local plans.
2. Training courses similar to the Mission 5000 and Operation Responsible should be developed for local officials on management responsibilities of a solid waste management system.
3. Research programs are needed which apply to rural solid waste management systems.
4. State legislation is needed which would allow local governments to pass revenue bonds for solid waste management facilities.
5. State legislation is needed which would provide a method for counties to collect for delinquent solid waste service charges without going to court.
6. State legislation is needed which would allow for the formation of multi-governmental bodies to manage or operate solid waste management facilities.
7. A State or Federal hazardous waste program needs to be established. The local governments cannot afford the staff necessary to properly manage hazardous waste problems.
8. Expansion of the Department of Conservation's river access point program is necessary to properly dispose of the refuse from people using the waterways.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Landfill Service Areas

Fig. 1

F Indicates Location of Sanitary Landfill

Study Area

Political Jurisdictions-- The Meramec Region consists of six counties and 26 incorporated cities or villages as listed in Table 2 . All the cities have the Council-Mayor form of government; the villages elect a Board of Trustees, and the County Courts consists of a Presiding Judge and two associate judges.

Population-- The population of the region is rather widely scattered. Rolla, the largest city, has a population of over 13,000, while the next largest city within the region has just over 4,300. Table 3 shows county background information on Housing data, Family income, assessed evaluation and population density. The figures on median family annual income can be compared to Jefferson City with $10,463, Kansas City with $11,285, Springfield with $8,125 and St. Louis with $10,961. Average annual family income in the counties of the region is considerably less than the large cities in Missouri. This indicates that in order for a proposed solid waste system to be affordable it must be appropriately less expensive.

The population projections in Fig. 2 a-f and Fig. 3 a-f assume continued existing trend based on the control population by county. The control was prepared by the Missouri Department of Community Affairs, State Highway Department, Office of Administrative Affairs, and University of Missouri. Projections for the minor civil divisions were justified to these county figures.

Industries-- Industrial refuse generation in the Region was found to be considerably less than in urban areas. This can be partially attributed to the fact that many residents who are employed in manufacturing commute into other areas. Also, with the increased price of certain salvaged material, recycling efforts in industries are increasing. Finally, the industries within the region usually pay lower wage rates and higher material costs due to transportation. This encourages industries to be more conservative with materials than industries in urban areas.

An industrial waste survey was conducted by mailing questionnaires and having personal interviews with the industries and refuse haulers. A summary of the results of this survey is shown in Table 4 . Waste generation was found to vary greatly between industries in each category so little correlation could be drawn between size or type of industry and waste generation.

TABLE 2 : POLITICAL JURISDICTION IN THE MERAMEC REGION

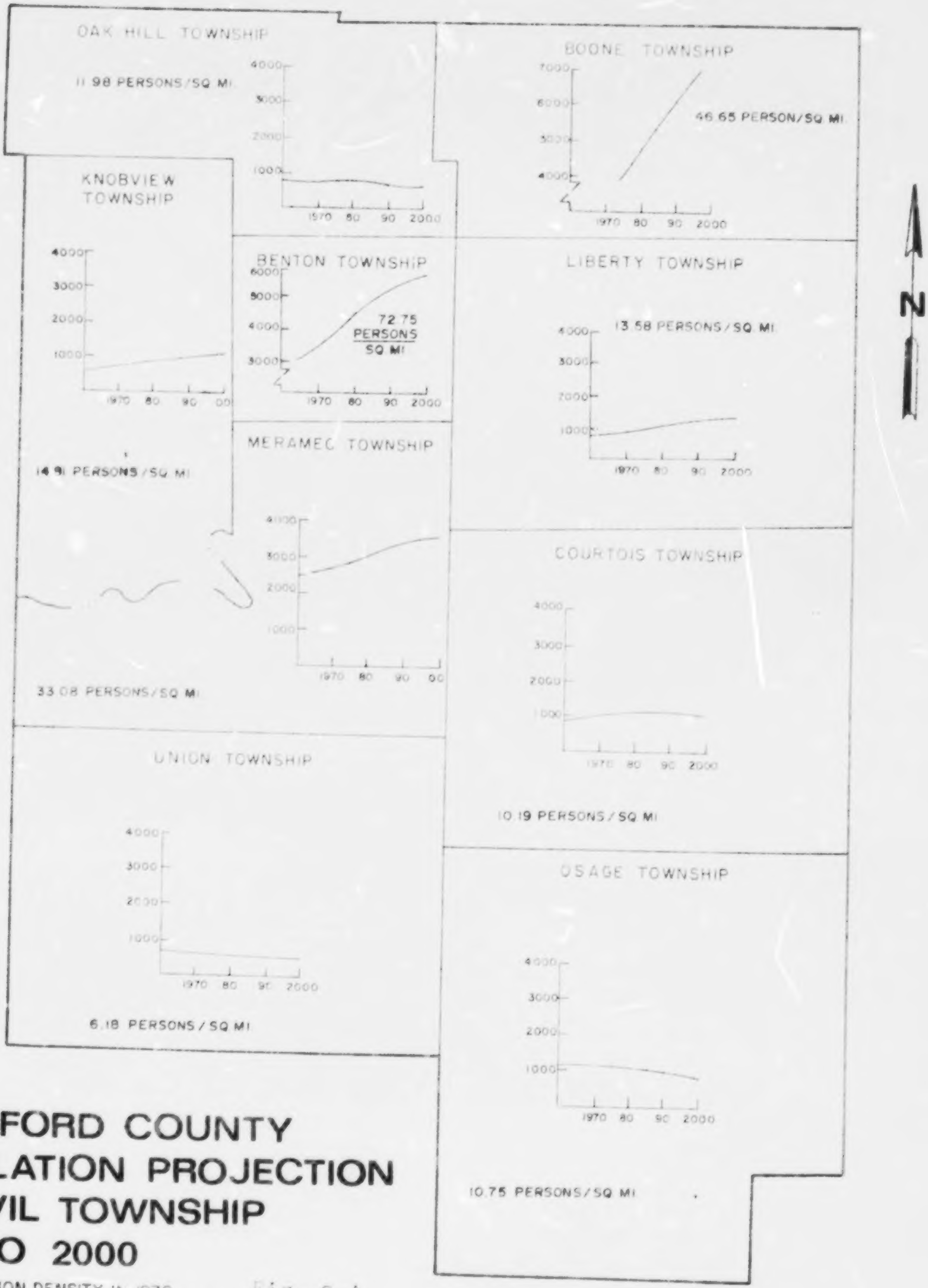
Political Jurisdiction	1970 Population	Classification	Presiding Judge or Mayor	Term of Office
Crawford Co.	14,828	Third	Orville L. Burnett	74
Bourbon	955	Fourth	Elmer G. King	72-76
Cherryville	47	Town	NA	NA
Cuba	2,070	Fourth	Carl Hunt	72-76
Dillard	36	Town	NA	NA
Leasburg	218	Village	Donald Vaughn	74-75
Steelville	1,392	Fourth	James Taylor	72-76
Sullivan	5,111	Third	Charles Clonts	73-75
Dent Co.	11,457	Third	Farris Gibbs	74
Bunker	447	Fourth	G.N. Patterson	73-75
Salem	4,363	Fourth	Clarence Inman	72-76
Gasconade Co.	11,878	Third	Harvey Hoener	74
Bland	621	Fourth	Willard Cautrell	74-76
Gasconade	235	Fourth	Raymond Haeffner	74-76
Hermann	2,658	Fourth	C.M. Bassman	72-76
Morrison	234	Fourth	Albert Rohlfing	72-76
Owensville	2,416	Fourth	Wesley Michel	72-76
Rosebud	305	Fourth	Kenneth Bohl	73-75
Maries Co.	6,851	Third	Travis John	74
Belle	1,133	Fourth	Ken McDaniel	74-76
Vienna	505	Fourth	Bill Hodge	73-75
Phelps Co.	29,567	Third	Leo Lorts	74
Doolittle	535	Fourth	Frank Carroll	73-75
Newburg	806	Fourth	Leonard Myers	74-76
Northwye	138	Village	Curtis Smith, Jr.	72-76
Rolla	13,571	Third	Herald Barnes, Jr.	73-78
St. James	2,929	Third	Melvin Matlock	73-75
Washington Co.	15,086	Third	Thomas Allen	74
Caledonia	113	Village	U.P. Wood	73-75
Irondale	319	Fourth	John A. Robinson	73-75
Mineral Point	369	Fourth	Silas Williams	72-76
Potosi	2,761	Fourth	Donnie Barton	72-76

Source: Meramec Regional Planning Commission

TABLE 3 : MERAMEC GENERAL COUNTY BACKGROUND INFORMATION

	Crawford	Dent	Gasconade	Maries	Phelps	Washington	Total
I. HOUSING DATA All Occupied Units	4,954	4,024	4,231	2,283	8,981	4,530	29,003
Incorporated % of Total	2,085 42.1%	1,787 44.4%	2,438 57.6%	589 25.8%	5,300 59.0%	1,181 26.0%	13,380 46.1%
Unincorporated % of Total	2,869 57.9%	2,237 55.6%	1,793 42.4%	1,694 74.2%	3,681 41.0%	3,349 74.0%	15,623 53.9%
Rural Farm % of Unincorp.	841 29.3%	801 35.8%	919 51.3%	762 45.0%	773 21.0%	860 25.7%	4,956 31.7%
Seasonal, Weekend, or Other Vacant	1,263	357	762	554	651	850	4,437
Farms 10 Acres or Larger	743	803	945	823	834	466	4,614
II. ECONOMIC DATA Median Family Income	$6,847	$6,048	$6,853	$6,220	$7,523	$6,125	---
Assessed Evaluation	$29,599,955	$25,844,580	$32,355,220	$15,512,900	$48,516,665	$39,343,700	---
III. POPULATION DENSITY Population Unincorp. Area	9,135	6,885	5,409	5,304	11,996	11,524	50,253
Area (sq. mi.)	760	756	519	525	677	760	3,997
Length of Roads (mi.)	803.6	803.7	687.5	609.4	803.4	608.1	4,315.7
Persons/Sq.Mi.	12.0	9.1	10.4	10.1	17.7	15.2	12.6
Persons/Road Mi.	11.4	8.6	7.9	8.7	14.9	19.0	11.6

Source: 1970 Census, Missouri State Highway Dept.; Meramec Regional Planning Commission.


OAK HILL TOWNSHIP
11.98 PERSONS/SQ MI
BOONE TOWNSHIP
46.65 PERSON/SQ MI
KNOBVIEW TOWNSHIP
14.91 PERSONS/SQ MI
BENTON TOWNSHIP
72.75 PERSONS SQ MI
LIBERTY TOWNSHIP
13.58 PERSONS/SQ MI
MERAMEC TOWNSHIP
33.08 PERSONS/SQ MI
COURTOIS TOWNSHIP
10.19 PERSONS/SQ MI
UNION TOWNSHIP
6.18 PERSONS/SQ MI
OSAGE TOWNSHIP
10.75 PERSONS/SQ MI
1000
2000
3000
4000
5000
6000
7000
1970
80
90
2000
N

CRAWFORD COUNTY POPULATION PROJECTION BY CIVIL TOWNSHIP 1970 TO 2000

AND POPULATION DENSITY IN 1970 Fig. 2-A

DENT COUNTY POPULATION PROJECTION BY CIVIL TOWNSHIP 1970 TO 2000

AND POPULATION DENSITY IN 1970

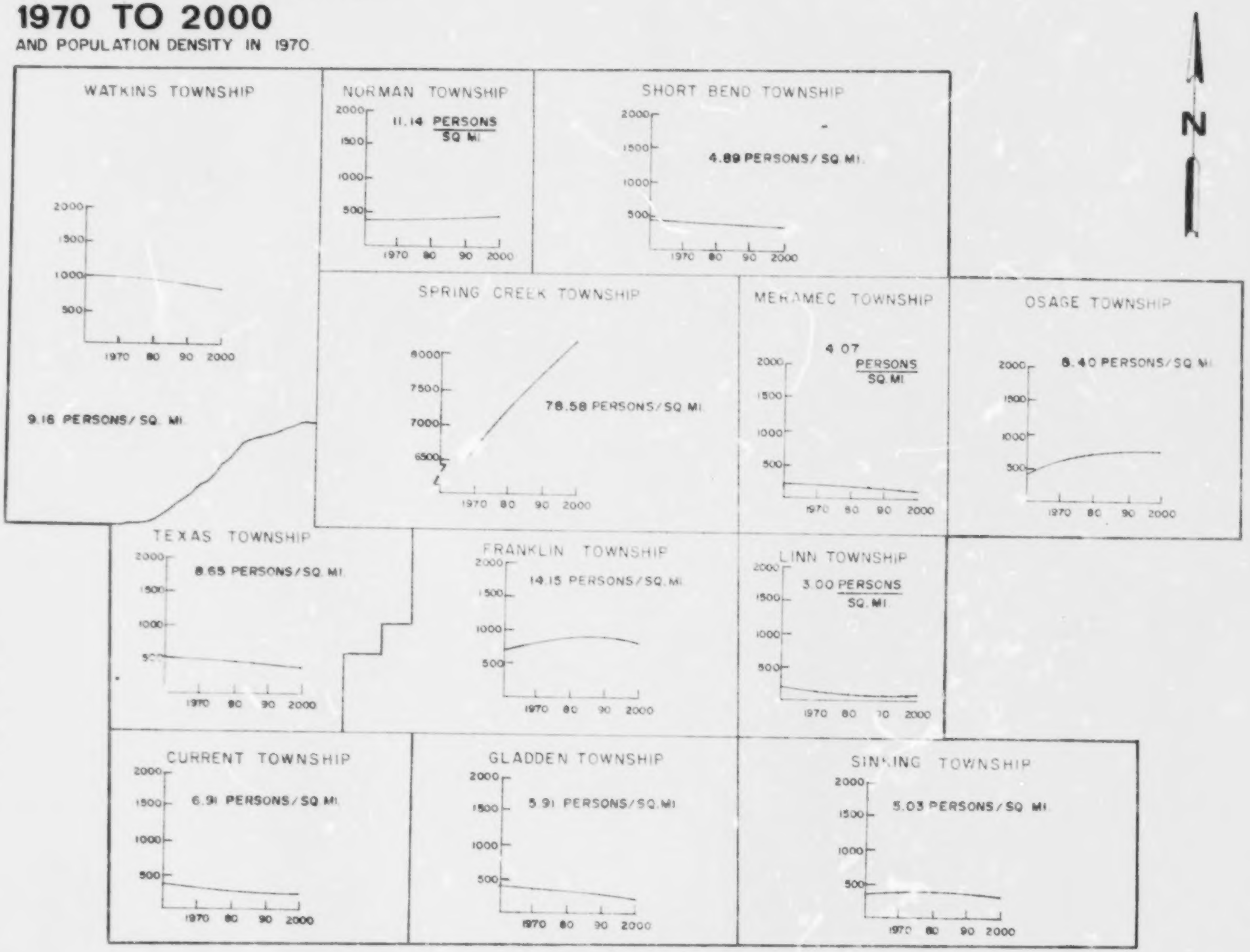
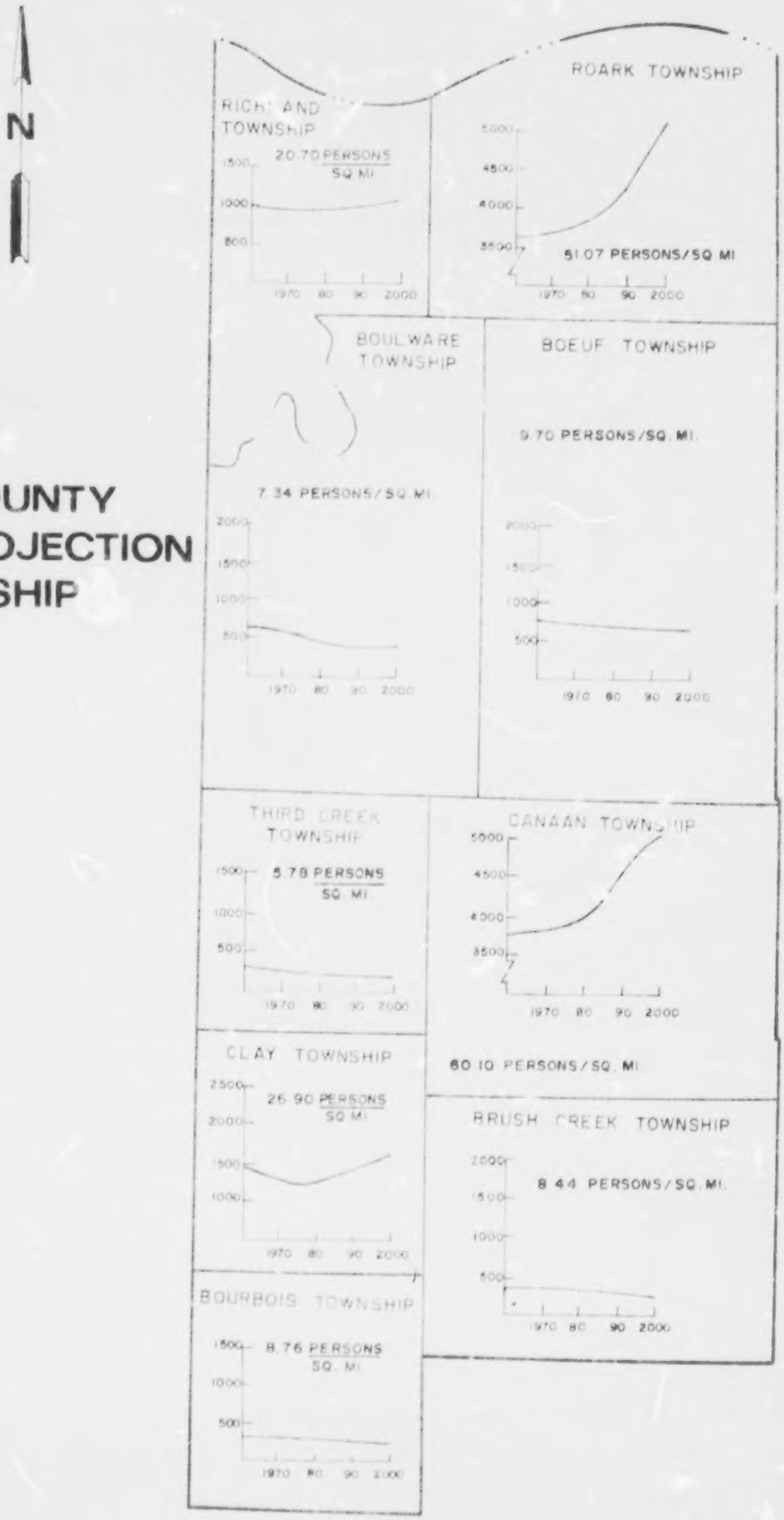

N
WATKINS TOWNSHIP
9.16 PERSONS/ SQ. MI.
NORMAN TOWNSHIP
11.14 PERSONS / SQ. MI.
SHORT BEND TOWNSHIP
4.89 PERSONS/ SQ. MI.
SPRING CREEK TOWNSHIP
78.58 PERSONS/ SQ. MI.
8000
7500
7000
6500
MERAMEC TOWNSHIP
4.07 PERSONS / SQ. MI.
OSAGE TOWNSHIP
8.40 PERSONS/ SQ. MI.
TEXAS TOWNSHIP
8.65 PERSONS/ SQ. MI.
FRANKLIN TOWNSHIP
14.15 PERSONS/ SQ. MI.
LINN TOWNSHIP
3.00 PERSONS / SQ. MI.
CURRENT TOWNSHIP
6.91 PERSONS/ SQ. MI.
GLADDEN TOWNSHIP
5.91 PERSONS/ SQ. MI.
SINKING TOWNSHIP
5.03 PERSONS/ SQ. MI.
2000
1500
1000
500
1970
80
90
2000

Fig. 2-B

GASCONADE COUNTY POPULATION PROJECTION BY CIVIL TOWNSHIP 1970 TO 2000

AND POPULATION DENSITY IN 1970



N
RICHLAND TOWNSHIP
20.70 PERSONS / SQ. MI.
1500
1000
500
1970 80 90 2000
ROARK TOWNSHIP
5000
4500
4000
3500
51.07 PERSONS/SQ. MI.
1970 80 90 2000
BOULWARE TOWNSHIP
7.34 PERSONS/SQ. MI.
2000
1500
1000
500
1970 80 90 2000
BOEUF TOWNSHIP
9.70 PERSONS/SQ. MI.
2000
1500
1000
500
1970 80 90 2000
THIRD CREEK TOWNSHIP
1500
5.78 PERSONS / SQ. MI.
1000
500
1970 80 90 2000
CANAAN TOWNSHIP
5000
4500
4000
3500
1970 80 90 2000
60.10 PERSONS/SQ. MI.
CLAY TOWNSHIP
2500
25.90 PERSONS / SQ. MI.
2000
1500
1000
1970 80 90 2000
BRUSH CREEK TOWNSHIP
2000
8.44 PERSONS/SQ. MI.
1500
1000
500
1970 80 90 2000
BOURBOIS TOWNSHIP
1500
8.76 PERSONS / SQ. MI.
1000
500
1970 80 90 2000

Fig. 2-C

MARIES COUNTY
POPULATION PROJECTION
BY CIVIL TOWNSHIP
1970 TO 2000

AND POPULATION DENSITY IN 1970.

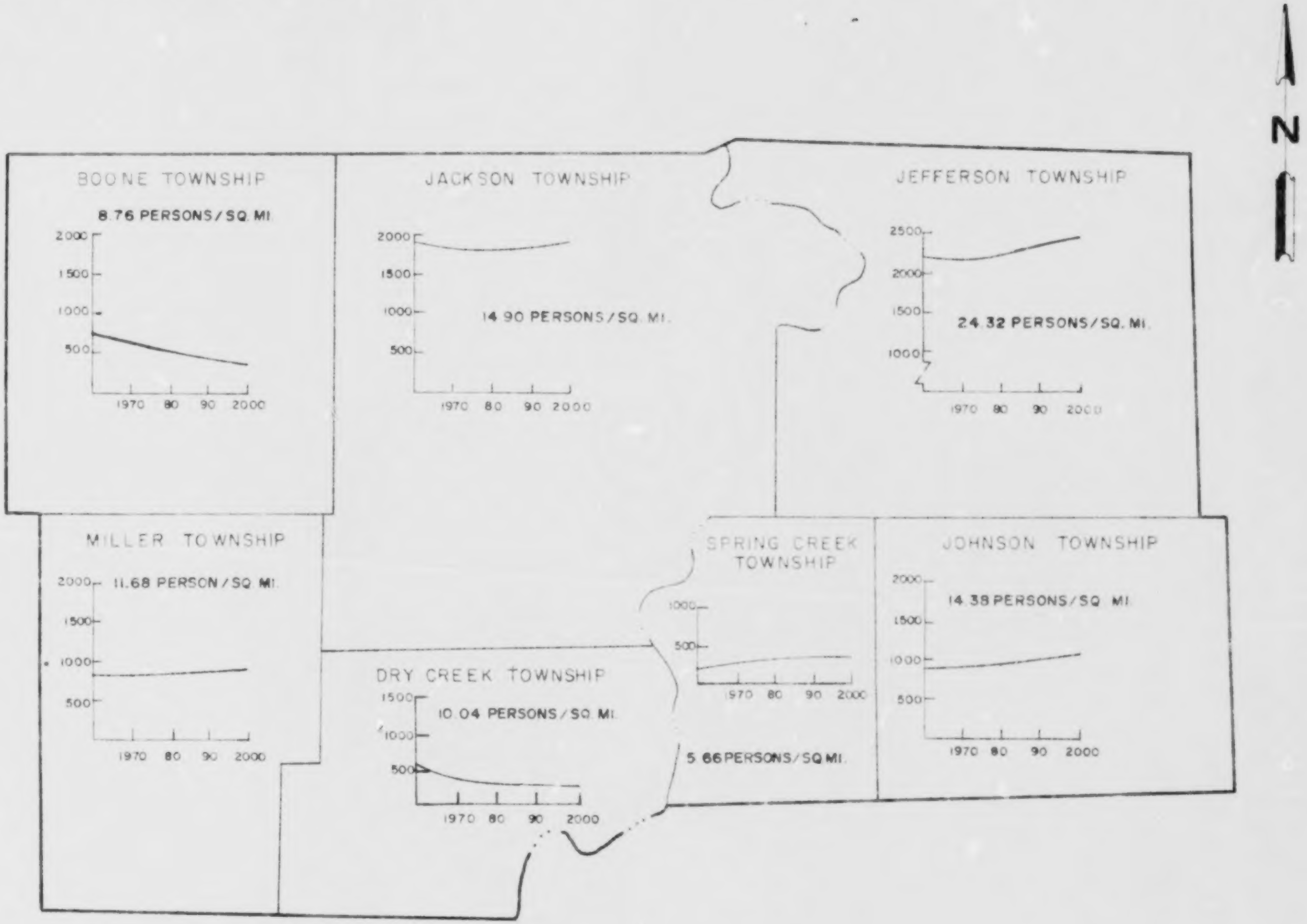

N
BOONE TOWNSHIP
8.76 PERSONS/SQ. MI.
2000
1500
1000
500
1970
80
90
2000
JACKSON TOWNSHIP
14.90 PERSONS/SQ. MI.
2000
1500
1000
500
1970
80
90
2000
JEFFERSON TOWNSHIP
24.32 PERSONS/SQ. MI.
2500
2000
1500
1000
1970
80
90
2000
MILLER TOWNSHIP
11.68 PERSON/SQ. MI.
2000
1500
1000
500
1970
80
90
2000
DRY CREEK TOWNSHIP
10.04 PERSONS/SQ. MI.
1500
1000
500
1970
80
90
2000
SPRING CREEK TOWNSHIP
1000
500
1970
80
90
2000
5.66 PERSONS/SQ. MI.
JOHNSON TOWNSHIP
14.38 PERSONS/SQ. MI.
2000
1500
1000
500
1970
80
90
2000

Fig. 2-D

PHELPS COUNTY POPULATION PROJECTION BY CIVIL TOWNSHIP 1970 TO 2000

AND POPULATION DENSITY IN 1970

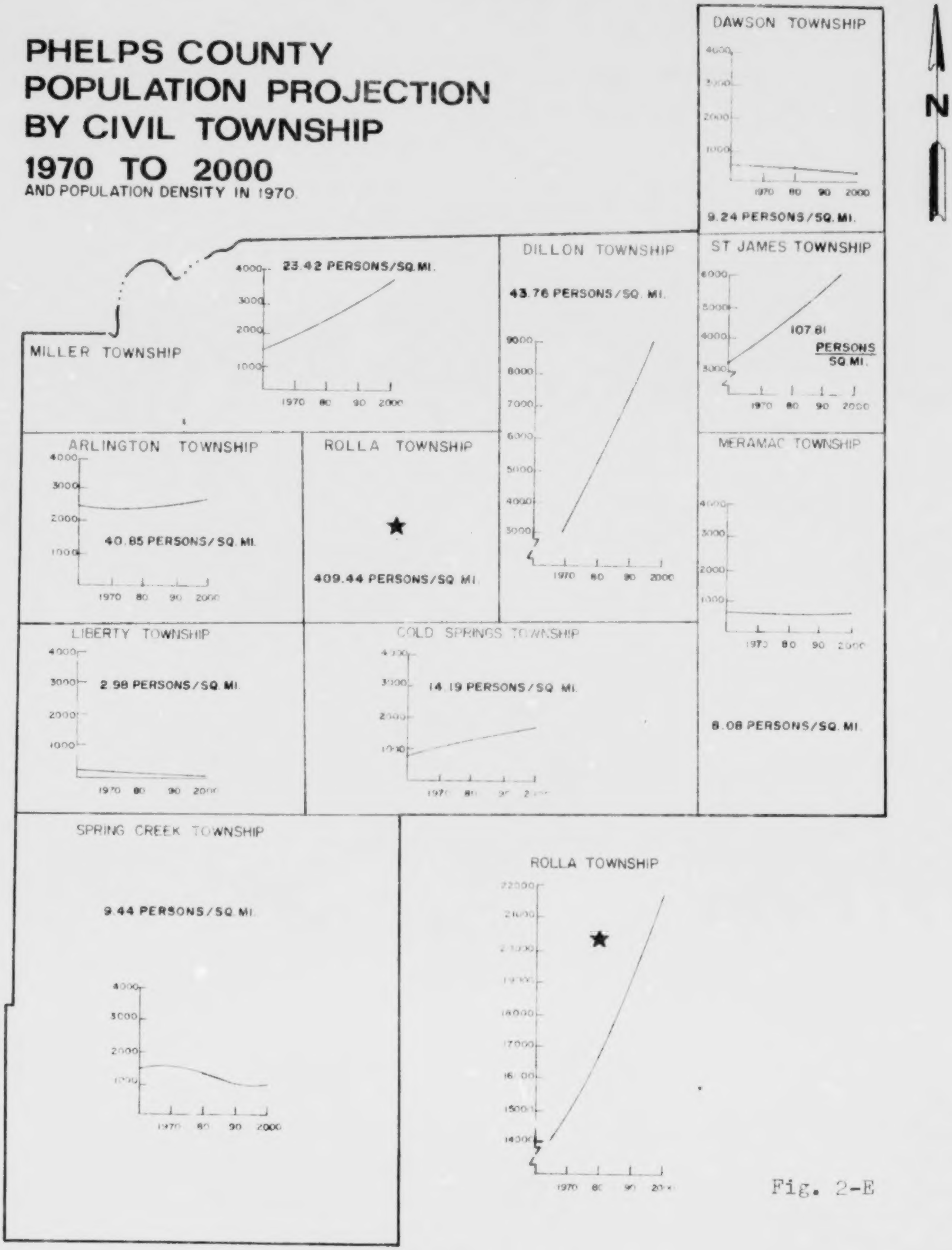

N
DAWSON TOWNSHIP
4000
3000
2000
1000
1970 80 90 2000
9.24 PERSONS/SQ. MI.
MILLER TOWNSHIP
23.42 PERSONS/SQ. MI.
4000
3000
2000
1000
1970 80 90 2000
DILLON TOWNSHIP
43.76 PERSONS/SQ. MI.
9000
8000
7000
6000
5000
4000
3000
1970 80 90 2000
ST JAMES TOWNSHIP
6000
5000
4000
3000
107.81 PERSONS/SQ. MI.
1970 80 90 2000
ARLINGTON TOWNSHIP
4000
3000
2000
1000
40.85 PERSONS/SQ. MI.
1970 80 90 2000
ROLLA TOWNSHIP
409.44 PERSONS/SQ. MI.
MERAMAC TOWNSHIP
4000
3000
2000
1000
1970 80 90 2000
8.08 PERSONS/SQ. MI.
LIBERTY TOWNSHIP
4000
3000
2000
1000
2.98 PERSONS/SQ. MI.
1970 80 90 2000
COLD SPRINGS TOWNSHIP
4000
3000
2000
1000
14.19 PERSONS/SQ. MI.
1970 80 90 2000
SPRING CREEK TOWNSHIP
9.44 PERSONS/SQ. MI.
4000
3000
2000
1000
1970 80 90 2000
ROLLA TOWNSHIP
22000
21000
20000
19000
18000
17000
16000
15000
14000
1970 80 90 2000

Fig. 2-E

WASHINGTON COUNTY POPULATION PROJECTION BY CIVIL TOWNSHIP 1970 TO 2000

AND POPULATION DENSITY IN 1970

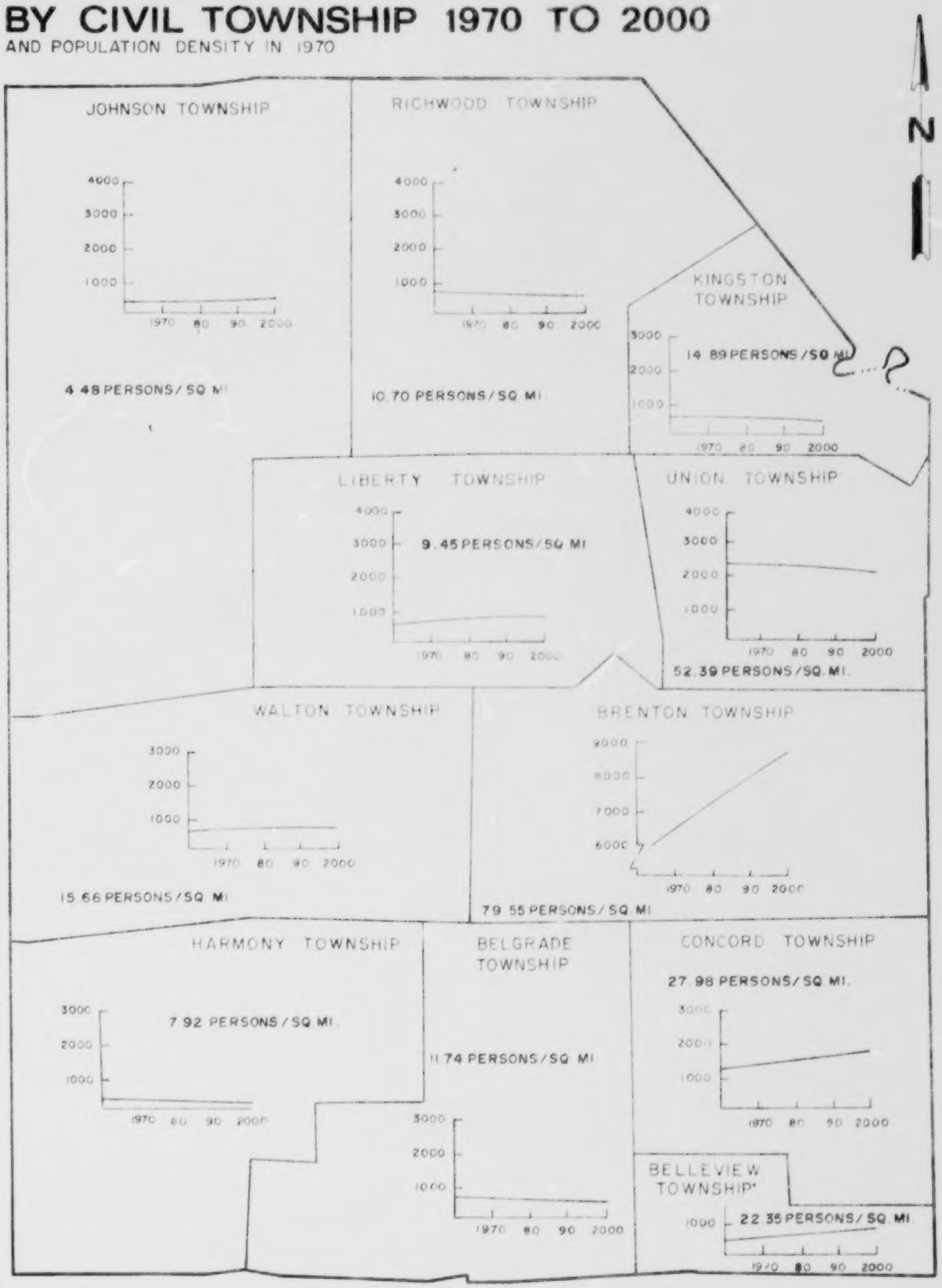

N
JOHNSON TOWNSHIP
4000
3000
2000
1000
1970 80 90 2000
4.48 PERSONS/SQ.MI.
RICHWOOD TOWNSHIP
4000
3000
2000
1000
1970 80 90 2000
10.70 PERSONS/SQ.MI.
KINGSTON TOWNSHIP
3000
2000
1000
14.89 PERSONS/SQ.MI.
1970 80 90 2000
LIBERTY TOWNSHIP
4000
3000
2000
1000
9.45 PERSONS/SQ.MI.
1970 80 90 2000
UNION TOWNSHIP
4000
3000
2000
1000
1970 80 90 2000
52.39 PERSONS/SQ.MI.
WALTON TOWNSHIP
3000
2000
1000
1970 80 90 2000
15.66 PERSONS/SQ.MI.
BRENTON TOWNSHIP
9000
8000
7000
6000
1970 80 90 2000
79.55 PERSONS/SQ.MI.
HARMONY TOWNSHIP
3000
2000
1000
7.92 PERSONS/SQ.MI.
1970 80 90 2000
BELGRADE TOWNSHIP
11.74 PERSONS/SQ.MI.
3000
2000
1000
1970 80 90 2000
CONCORD TOWNSHIP
27.98 PERSONS/SQ.MI.
3000
2000
1000
1970 80 90 2000
BELLEVIEW TOWNSHIP
1000
22.35 PERSONS/SQ.MI.
1970 80 90 2000

Fig. 2-F

CRAWFORD COUNTY POPULATION PROJECTION BY CITIES & COUNTY 1970 TO 2000

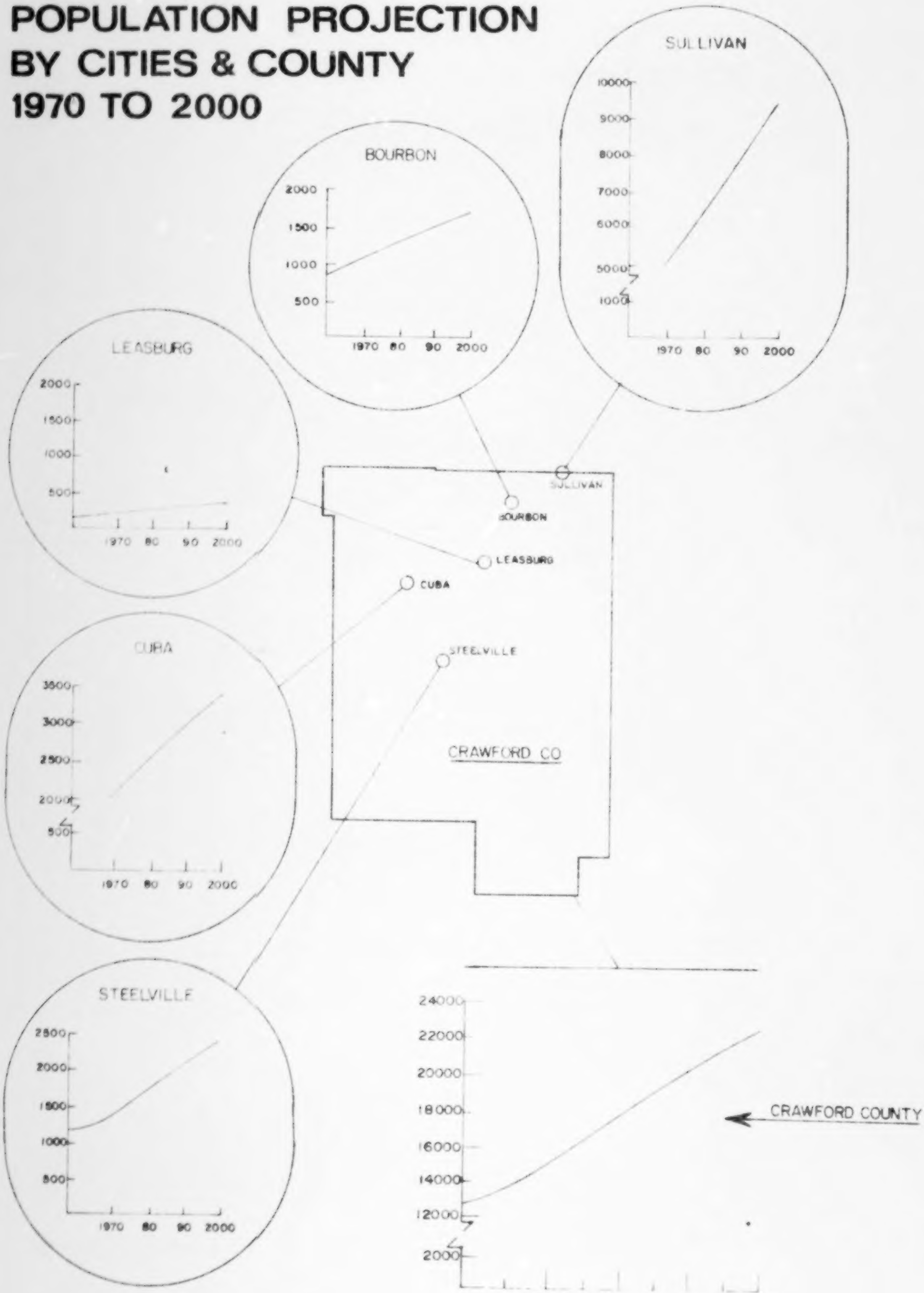


Fig. 3-A

DENT COUNTY
POPULATION PROJECTION
BY CITIES & COUNTY
1970 TO 2000

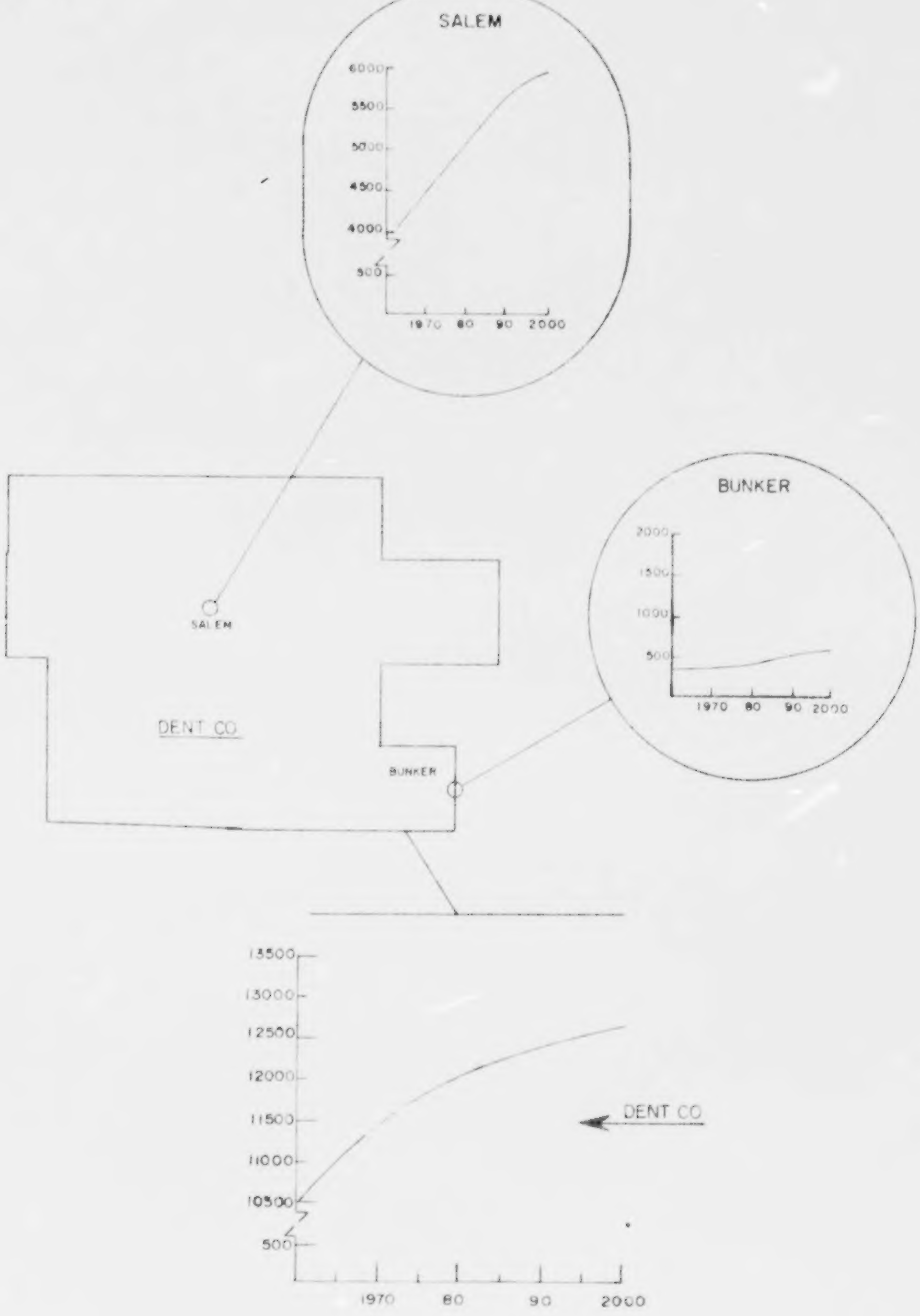


Fig. 3-8

GASCONADE COUNTY
POPULATION PROJECTION
BY CITIES & COUNTY 1970 TO 2000

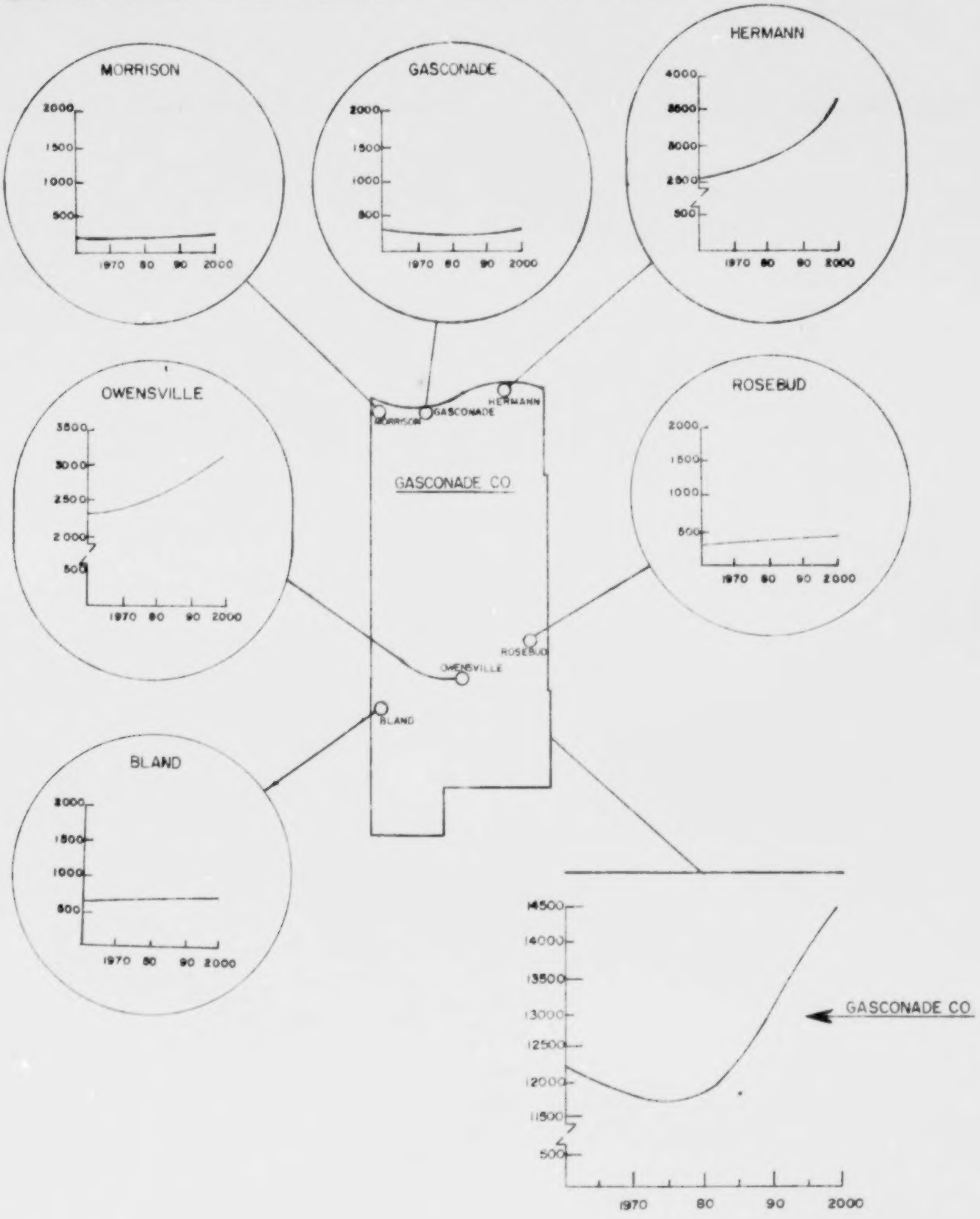


Fig. 3-C

MARIES COUNTY
POPULATION PROJECTION
BY CITIES & COUNTY 1970 TO 2000

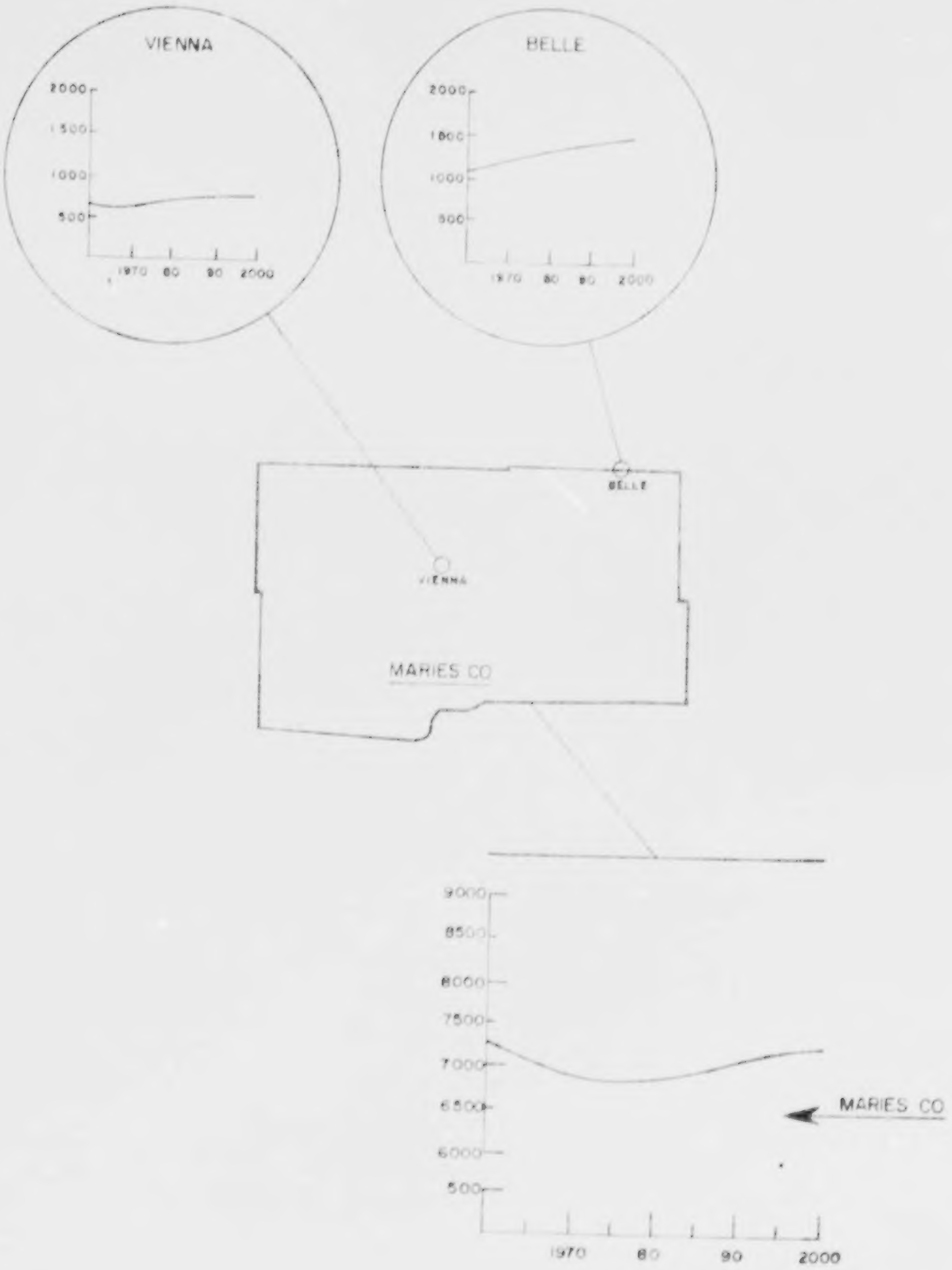


Fig. 3-D

PHELPS COUNTY
POPULATION PROJECTION
BY CITIES & COUNTY 1970 TO 2000

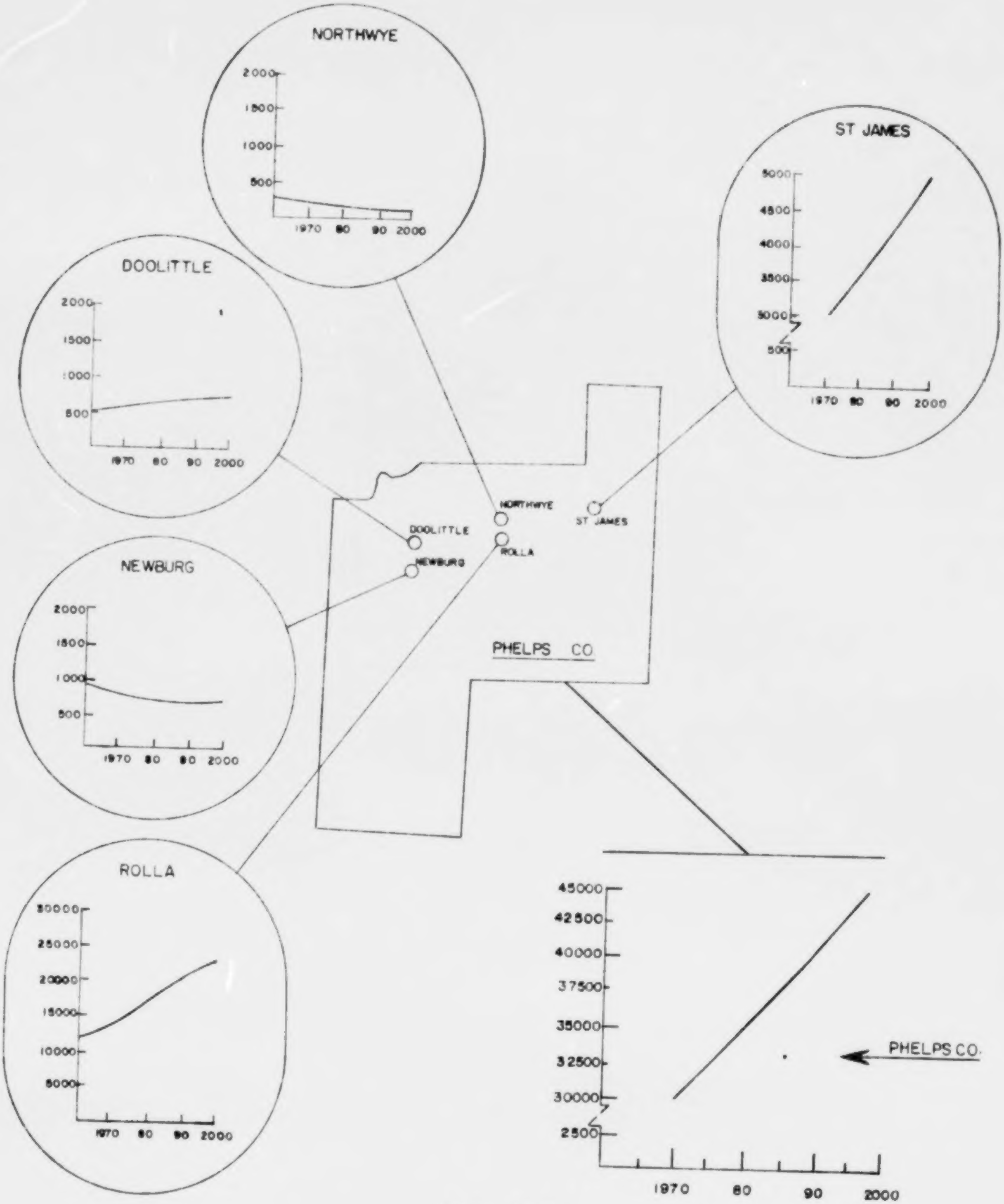


Fig. 3-E

WASHINGTION COUNTY
POPULATION PROJECTION
BY CITIES & COUNTY 1970 TO 2000

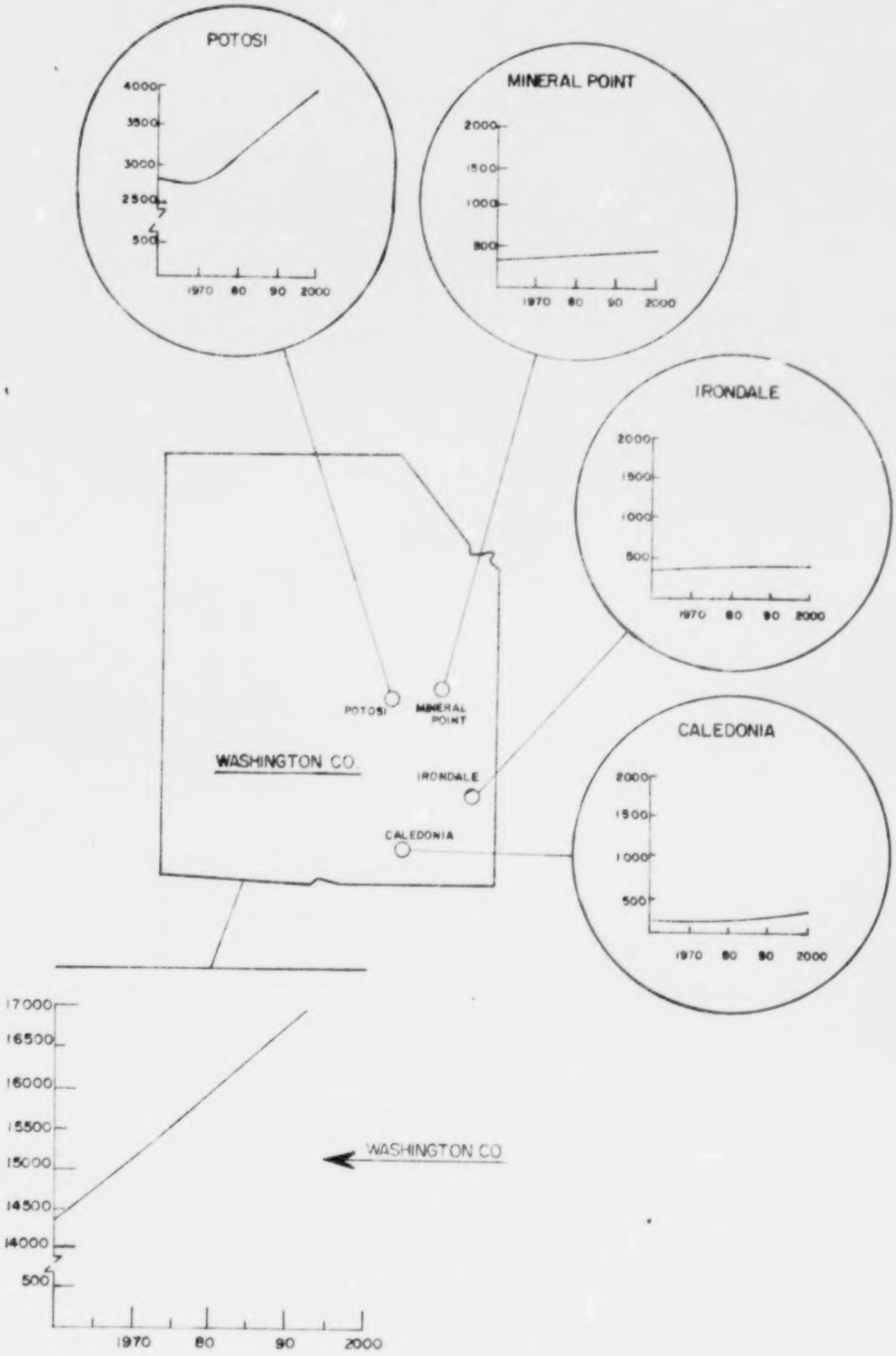


Fig. 3-F

TABLE 4 : SUMMARY INDUSTRIAL WASTE SURVEY

Type of Industry	Principal Products	No. in Region	Principal Type of Waste	How Waste is Disposed
Wood Products Industries	Lumber, Charcoal, Pressure-treated wood, flooring and cabinets	31	Sawdust and Wood Slabs	Sawdust and slabs are used in manufacturing of charcoal; smaller firms give sawdust away for mulching and slabs for kindling.
Paper Related Industries	Newspapers, Printing, Book Binding and Box-folding	23	Paper, cardboard	With the increased price of recycled paper, most industries are are salvaging paper; remainder taken to dump.
Mining Company	Sand and Gravel, Fire Clay, Lead, Zinc, Iron, & Barite	20	Mining waste	Some industries produce significant amounts of waste, such as 1.5 million tons of ground limestone per year. This waste is not included in Mo. Solid Waste Management Act.
Concrete Industries	Ready-Mix concrete and concrete blocks	17	Sand, Gravel and concrete	Most plants have on-site disposal facilities.
Shoe Products Industries	Shoes and shoe parts	15	Leather, rubber, paper, wood, metal, and glue	Usually stored in old stake trucks and hauled to city dump as needed. Largest industrial waste producers in Region.
Metal Fabricating Firms	Sheet Metal work, wire products, metal parts	11	Metal, paper and wood	Metal and paper are largely recycled.

TABLE 4 : SUMMARY INDUSTRIAL WASTE SURVEY

Type of Industry	Principal Products	No. in Region	Principal Type of Waste	How Waste is Disposed
Garment Factories	Clothes, Hats, and Sportswear	9	Cloth, Rubber, Paper, sawdust	Cloth is usually sold or given away. The wastes are taken to the dump.
Chemical Co.	Chemicals	8	Liquid	NA-Waste could be hazardous
Food Processing	Meat Packing, Dairys, wineries, and soft drinks.	Many	Meat scraps, Grape pulp, paper and glass	Meat scraps are sold to rendering companies; grape wastes are composted; remainder taken to dumps.
Plastic Manufacturers	Plastic Products	3	Plastic, paper	Usually plastic is recycled within the plant, remainder taken to dumps. Waste could be hazardous.

NA - Information not made available

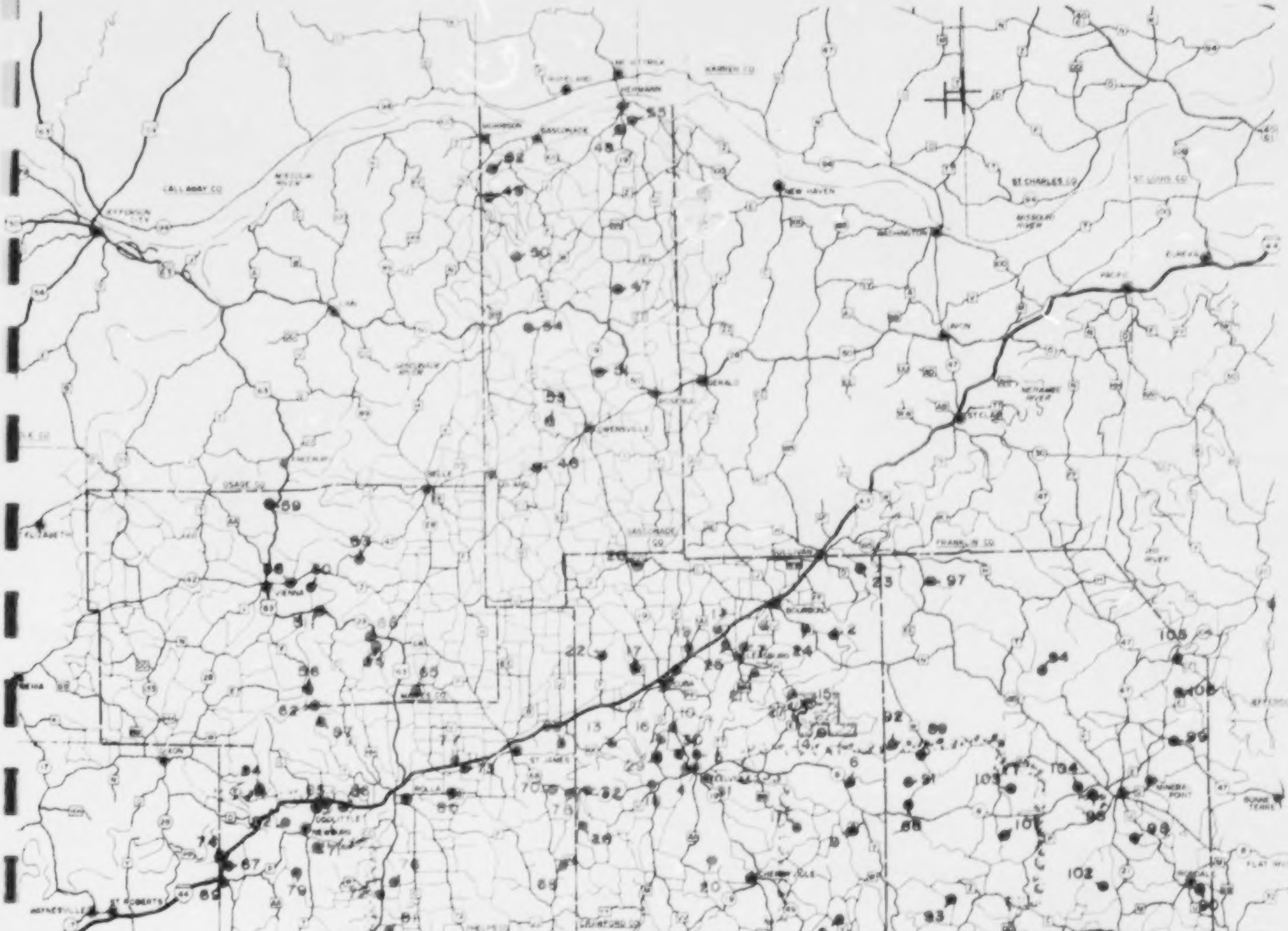
Recreation Areas-- Refuse from recreational areas are expected to have a significant effect on the proposed solid waste management systems, especially in Crawford, Washington and Gasconade Counties. When compared to the total annual generation, recreational generation is relatively small. However, the generation is concentrated in the summer months. Since a larger amount of food waste is found in recreational refuse, it will also be more difficult to handle than the other refuse. As shown in Figure 4 and Table 5 many of the recreational areas are located in out-of-the-way areas which causes increases in collection costs.

In addition to the recreational areas, there is a significant number of seasonal and week-end homes as indicated in Table 3 . The total number of seasonal and week-end homes in the Region is equivalent to a city the size of Rolla. A reliable method of estimating refuse generation from those homes is not available because of the difficulty in estimating how often they are in use. It was also found that an estimate of the refuse generation from the private recreational areas would be little more than a guess, because of a lack of records. Reliable data on waste generation was available for the State and Federally managed areas, but these are only a small part of the total. It is evident the proposed solid waste management systems must be designed flexibly enough to account for a large seasonal variation in the recreational areas.

Much of the recreational refuse is from boaters on the rivers. Until recently, these river access points have been unmanaged areas at road crossings. With no trash cans available, a person had the choice of either taking his trash home with him or dumping it in the river. Unfortunately, dumping it in the river was more convenient. In the last few years the Conservation Commission has been developing river access points with trash cans. If this program can be expanded, it will greatly aid in cleaning- up the riverways.

If the proposed Meramec Reservoir is built, the waste generation in Crawford and Washington Counties will sharply increase. It is estimated this project would be completed by 1980. Figure 5 illustrates the location of proposed recreational sites around the reservoir and Table 6 indicates the development agency, proposed use, and number of users for these and other sites.

Transportation System-- The highways, railways, and airports in the region and surrounding area are indicated in Figure 6 . It should be noted that every city in the Region with a population over 600 is served by a railroad. Highways which have been authorized for higher weight restrictions have been indicated in Figure 7 , and Table 7 lists the weight limitations.



MERAMEC REGION
PREPARED BY
MERAMEC REGIONAL PLANNING COMMISSION
SOURCE
MISSOURI STATE HIGHWAY DEPARTMENT BASE MAP 1972
U.S. ARMY MAP SERVICE MAPS NJ 15-8, NJ 15-9 1955
N
SCALE OF MILES
NATIONAL
FOREST
SALEM
ROLLA
ST JAMES
NEW HAVEN
WASHINGTON
ST ROBERTS
WAYNESVILLE
FORT LEONARD WOOD
VIENNA
OWENSVILLE
DOOLITTLE
CENTERVILLE
MERAMEC RIVER
MISSOURI RIVER

Recreation Facility Locations

Fig. 4

TABLE 5 : RECREATIONAL FACILITIES IN THE MERAMEC REGION

Number	Type of Site	Type of Control	Access via Highway	Site Size in Acres	Picnicing	Camping	Water Sports	Play Area
	CRAWFORD COUNTY SITES							
1	Bourbon Lake	Com	Co 231	35			X	
2	Camp River Cliff	PP	Co 142	78	X	X		X
3	Casa de Familias Campground	Com	Mo P	25		X		
4	Cobblestone Resort	Com	Mo 19	15	X		X	
5	County Beach	CoC	Mo 211	8			X	
6	Courtois Creek Roadside Park	MHC	Mo 8	2	X			
7	Crote Mac Lake	Com	Co 217	155			X	
8	Davisville Campground	FFS	F 2253	106	X	X	X	X
9	Eagle Hurst Ranch (resort)	Com	Mo Z	700	X		X	X
10	Evco Golf Course	PM	Mo 19	75				
	Merrihills Golf Course	Com	Mo 19	55				
11	Fisherman's Dude Ranch	Com	Mo BB	500			X	
12	Fort West Side (resort)	Com	Mo N	228	X	X	X	X
13	Fox Springs Lodge (resort)	Com	Mo KK	60			X	X
14	Huzzah Country Club	PM	Co 158	586				
15	Huzzah Wildlife Mgt. Area	MCC	Mo E,H	6078		X	X	
16	Idlewild Lodge (resort)	Com	Co 69	58	X	X	X	
17	Indian Hills Subdivision	PM	Mo DD	326			X	
18	Indian Springs Lodge (resort)	Com	Mo 8	375	X	X	X	X
19	Jellystone Park (resort)	Com	Mo UU	80	X	X	X	X
20	Keysville Towersite	MCC	Mo AA	80				
21	Leasburg Towersite	MCC	Mo H	5				
22	McDade Springs Lake	Com	Mo F	40		X	X	
23	Meramec State Park (most of 7155 acres in Franklin Co.)	MPB	Mo 185		X	X	X	X
24	Mihaska Resident Camp	PM	Mo N	800				
25	Mobil Trailer Pk. & Campsite	Com	I-44		X	X		
	Oak Grove Roadside Park	MCC	I-44	3	X			
	Outpost (souvenir shop)	Com	I-44					X
26	Mound Ridge Presbyterian Camp	PM	Co. 240	372		X		
27	Onondaga Cave Park	Com	Mo H	1000	X	X	X	X
28	Ozark Playground (Oak Hill)	Com	Mo 19	840				
29	Riverview Access	MCC	Mo O	6			X	
30	Riverview Roadside Park	MHC	Mo 19	2	X			
31	Wildwood Springs (Steelville)	Com	Grand	71			X	X
32	W.K. Woods Mem.Wildlife Area	MCC	Mo 8	3434			X	X
	DENT COUNTY SITES							
33	Cedar Cliff Lodge	Com	Mo 119	4	X	X	X	
34	Honey Lake	Com	Mo 19	214	X		X	

TABLE 5 : RECREATIONAL FACILITIES IN THE MERAMEC REGION

Number	Type of Site	Type of Control	Access via Highway	Site Size in Acres	Picnicking	Camping	Water Sports	Play Area
35	Indian Trail State Forest	MCC	Co 54, 55,56, & 57	13,256	X			
36	Lake Spring Community Park	PP	Mo 72	1	X			X
37	Lenox Towersite	MCC	Mo C	5				
38	Little Scotia Pond	FFS	Co 90		X	X	X	
39	Montauk State Park	MPB	Mo 119	1,096	X	X	X	X
40	Montauk Towersite	MCC	Co 162	40				
41	Ozark Natl. Scenic Riverways	FPS	Co 151 & 152	2,552	X	X	X	
42	Putman Lake	Com	Mo 68	31	X	X	X	
43	Salem Golf & Country Club	PM	Mo J	115				X
44	Spencer Memorial Camp Church	PM	Mo YY	30				
45	Villa Kent	Com	Mo 19	34				X
	GASCONADE COUNTY SITES							
46	Canaan Towersite	MCC	Mo 28	5				
47	Drake Towersite	MCC	Mo 19	11				
48	Frene Valley Roadside Park	MHC	Mo 19	5	X			
49	Fredericksburg Ferry Access	MCC	Co 56	5			X	
50	Helds Island Access	MCC	Co 61	10			X	
51	Lake Northwoods Estates	PM	Mo 19	857	X		X	
52	Memory Lake	Com	Mo 10	190	X	X	X	X
53	Peaceful Valley Subdivision	PM	Mo Y	176		X	X	X
54	Picnic Area (near Mt. Sterling)		Mo 50		X			
55	See Tal Subdivision	PM	Mo 19	20			X	
	MARIES COUNTY SITES							
56	Bell Chute Access	MCC	Co 137	6			X	
57	C & H Resort	Com		2	X	X	X	
58	Driftwood Cabins	Com	Mo 42	3	X		X	X
59	Freeburg Towersite	MCC	US 63	13	X			
60	Indians Ford Cabins (resort)	Com	Mo 42	3	X		X	X
61	James Resort	Com	US 63	18	X	X	X	
62	Nagogami Lodge (private res.)	PM	Mo E	50			X	
63	Pay Down Access	MCC	Co 43	5			X	
64	Spring Creek Gap Roadside Pk.	MHC	US 63	10	X			
65	Vichy Campground (church camp)	PM	Co 104					
66	Vichy Towersite	MCC	US 63	283				

TABLE 5 : RECREATIONAL FACILITIES IN THE MERAMEC REGION

Number	Type of Site	Type of Control	Access Via Highway	Site Size in Acres	Picnicing	Camping	Water Sports	Play Area
	PHELPS COUNTY SITES							
67	Arlington Riverview	Com	I-44			X		
68	Asher Towersite	MCC	Mo NN	20				
69	B & S Boatdock (Jerome)	Com	Mo D	4				
70	Bucks Lodge (race track)	Com	Mo 8	60		X		X
71	Catfish Lake (near Newburg)	Com	Mo T	4	X		X	
72	Circle 4 Campground (Vida)	Com	US 63	12	X	X		X
73	Country-Air Campground	Com	I-44	12	X	X	X	X
74	Jerome Access (Gasconade R.)	MCC	Mo D	10			X	
75	Lane Springs	FFS	US 63	30	X	X	X	X
76	Little Beaver Archery Range	PM	US 63	70	X	X		X
77	Little Prairie Lake	MCC	Mo RA	314	X		X	
78	Meramec Springs Park	PP	Mo 8	1756	X		X	X
79	Mill Creek	FFS	Co 245	19	X	X	X	X
80	Oak Meadow Country Club	PM	Mo BB	157			X	X
81	Pilot Knob Towersite	MCC	US 63	24				
82	Rodgers Overnight	Com			X			
83	Rosati Towersite	MCC	Mo KK	92				
84	Sugar Tree Club (resort)	Com	Co 5	986				
85	Twin Oaks Lake	Com	Co 14	3			X	
86	West Trailer Park	Com	Old 66	9	X	X	X	X
86	Wo-He-Lo Woods Resident Camp	PM	Mo E	525				
	WASHINGTON COUNTY SITES							
88	Berryman	FFS	Co 68	19	X	X		
89	Brazil Creek Campsite	FFS	Mo W			X		
90	Camp Irondale Estates	PM	Co 88	16			X	X
91	Edward Beecher Campsite	FFS	F 2265		X	X		
92	Harmon Springs Campsite	FFS	F 2265			X		
93	Hazel Creek	FFS	Co 78		X	X		
94	High Point Towersite	MCC	Co 146	10				
95	Hillview Lake	Com	Mo 32	145	X	X	X	X
96	Historical Marker (Potosi)	MHC	Mo 8	$\frac{1}{4}$	X			
	Lions Club Park	PP	Mo 8	17	X		X	
97	Kellcter Towersite	MCC	Mo 185	9				
98	Potosi Towersite	MCC	Mo U	80				
99	Powder Springs Lake		Mo 47,E	164	X	X	X	X
100	Roadside Park	MHC	Mo 21		X			
101	Shirley Picnic Grounds	FFS	Mo 8	8	X	X		X
102	Sleepy Hollow Lake	Com	Co 6	60			X	
103	Sunnen Lake Facilities (various owners)	PM	Mo AA		X	X	X	X

TABLE 5 : RECREATIONAL FACILITIES IN THE MERAMEC REGION

Number	Type of Site	Type of Control	Access via Highway	Site Size in Acres	Picnicing	Camping	Water Sports	Play Area
104	Washington Co. Saddle Club	PM	Mo 185		X			
105	Washington State Park	MPB	Mo 21	1384	X	X	X	X
106	Washington Towersite	MCC	Co 33	3				

Abbreviations used for Type of Control:

FFS	United States Forest Service
MCC	Missouri Conservation Commission
MPB	Missouri Park Board
Com	Commercial enterprise open to the public by payment of a fee
PM	Private, admission only to members or by permission of members
PP	Private ownership, open to the general public
FPS	National Park Service
MHC	Missouri Highway Commission
CoC	County Court

Source: Meramec Regional Planning Commission

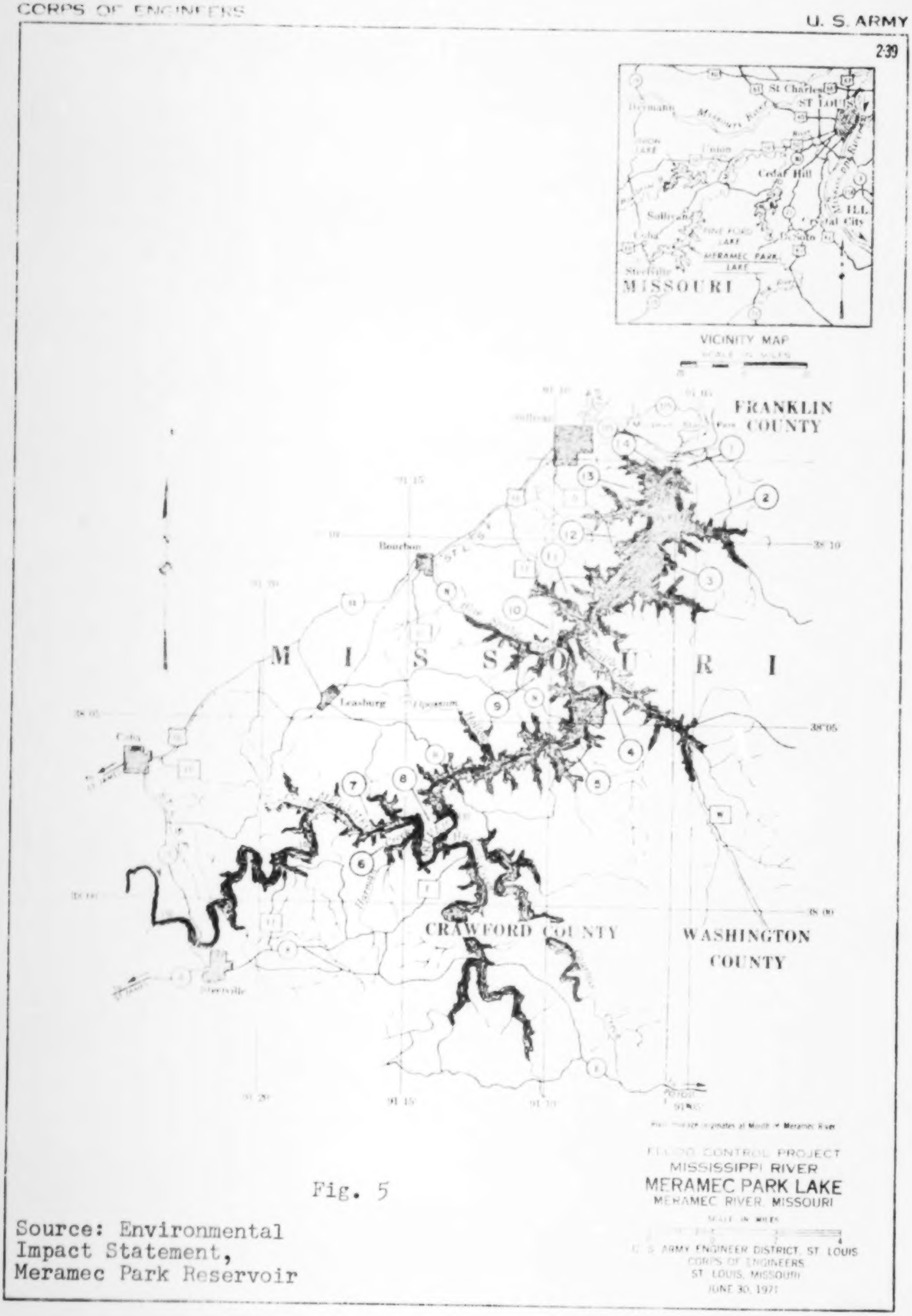

CORPS OF ENGINEERS
U. S. ARMY
239
St Charles
ST LOUIS
Hermann
Missouri River
Union
Cedar Hill
Sullivan
Cuba
PINE FORD LAKE
MERAMEC PARK LAKE
Steelville
MISSOURI
ILL.
Crystal City
DeSoto
VICINITY MAP
SCALE IN MILES
FRANKLIN COUNTY
Bourbon
Leasburg
Opossum
Cuba
Steelville
M I S S O U R I
CRAWFORD COUNTY
WASHINGTON COUNTY
FLOOD CONTROL PROJECT
MISSISSIPPI RIVER
MERAMEC PARK LAKE
MERAMEC RIVER, MISSOURI
SCALE IN MILES
U. S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS
ST. LOUIS, MISSOURI
JUNE 30, 1971

Fig. 5

Source: Environmental
Impact Statement,
Meramec Park Reservoir

TABLE 6 : PROPOSED (MERAMEC PARK LAKE) RECREATION USE

Site	Development Agency	Use			Annual User Days
		Concessions	Camping	Picnicing	
1	MCC & CE			X	87,600
2	CE	X		X	163,700
3	CE	X	X	X	144,900
4	MSPB & CE	X	X	X	280,400
5	Con.	X			60,500
6	Con.	X			23,600
7	CE	X		X	79,000
8	CE	X	X	X	97,800
9	MSPB & CE	X	X	X	294,500
10	CE	X	X	X	199,500
11	CE	X	X	X	107,300
12	MSPB		X	X	241,600
13	CE	X	X	X	99,700
14	CE			X	99,100

Subtotal	1,979,200
Organized Group Camping	121,000
Other Recreational Use on Project --- Land	364,200
Sightseers	1,189,400
TOTAL	3,653,800

MCC - Missouri Conservation Commission
MSPB - Missouri State Park Board
Con - Concession
CE - Corps of Engineers

Source: Environmental Impact Statement, Meramec Park Reservoir.

Transportation Facility Locations

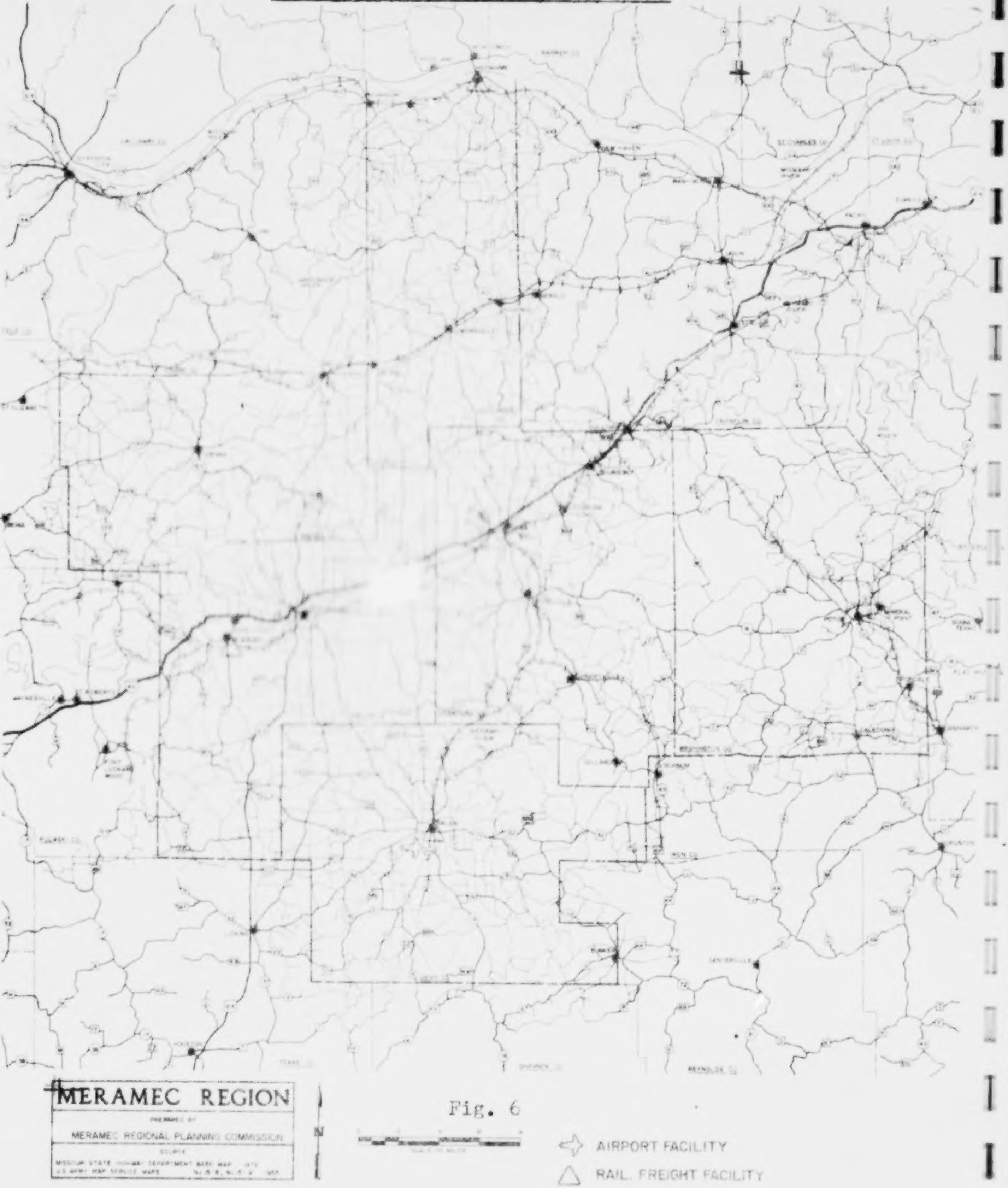

MERAMEC REGION
PREPARED BY
MERAMEC REGIONAL PLANNING COMMISSION
SOURCE
MISSOURI STATE HIGHWAY DEPARTMENT BASE MAP 1972
U.S. ARMY MAP SERVICE MAPS NJ 15-8, NJ 15-9 1958
N
SCALE IN MILES
AIRPORT FACILITY
RAIL FREIGHT FACILITY
P PROPOSED FACILITY
HOUSTON
TEXAS CO.
SHANNON CO.
REYNOLDS CO.
ST. CHARLES CO.
ST. LOUIS CO.
PULASKI CO.
WASHINGTON CO.
IRON CO.
CENTERVILLE
FORT LEONARD WOOD
ST. ROBERT
WAYNESVILLE

Fig. 6

Higher Weight Limitation Highways and Bridges

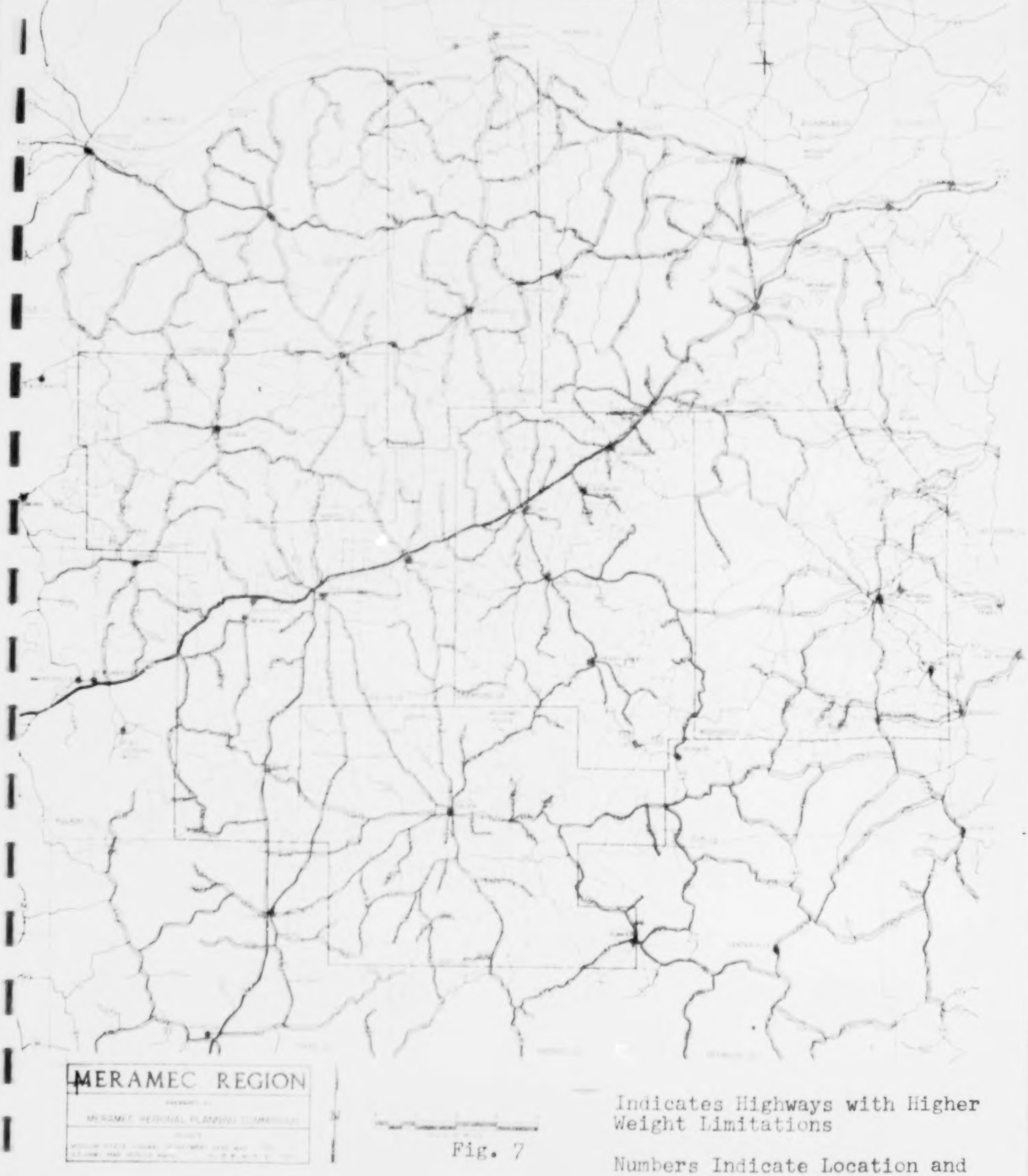

MERAMEC REGION
MERAMEC REGIONAL PLANNING COMMISSION

Fig. 7

Indicates Highways with Higher Weight Limitations

Numbers Indicate Location and Bridge Weight Limitations in Tons

TABLE 7: LEGAL LIMITS ON MISSOURI HIGHWAYS SHOWN IN FIG. 7

Width -- 8 ft.
Height -- 13½ ft.
Length -- 55 ft.

Single Axle -- 18,000 lbs.
Tandem Axles -- 32,000 lbs.

Distance in Ft. Between First and Last Axle	Max. Load in lbs. on Group of Axles	Distance in Ft. Between First and Last Axle	Max. Load in lbs. on Group of Axles
4 to 7	32,000	26	54,000
8	33,200	27	55,000
9	34,400	28	56,000
10	35,600	29	57,000
11	36,800	30	58,000
12	38,000	31	59,000
13	39,200	32	60,000
14	40,400	33	61,100
15	41,600	34	62,200
16	42,800	35	63,500
17	44,000	36	64,000
18	45,200	37	65,900
19	46,400	38	67,100
20	47,600	39	68,300
21	48,800	40	69,700
22	50,000	41	70,800
23	51,000	42	72,000
24	52,000	43 and over	73,280
25	53,000		

On all State Highways not shown on this map, bridges will be posted for a maximum legal load limit of 64,650 lbs. or less.

Geology-- The geology of the Meramec Region, shown in Figure 8 , is of three general types: the southern section of the region composed of thick soil over massive bedrock; a northern region composed of carbonate rock and deposits of sandstone and shale mixed with fireclay which varies in thickness from 10 to over 100 feet; and a section in eastern Maries county where the bedrock is covered by a thin, glade type soil. There is also a small karst area in central Dent County and an alluvial floodplain in northern Gasconade county, both of which are unsuitable for a sanitary landfill.

In the southern section of the region, the suitability of the land for solid waste disposal is variable. If the clay in the soil at a particular location is nonpermeable rather than filled with gravel or sandy soil, and if it is thick enough, then the site would hold water well enough to be used as a sanitary landfill. Any area considered a potential landfill site would need to be examined by a geologist before a decision is made. Another factor which would need to be considered is the possibility of overflow or leakage from the landfill escaping into a nearby stream channel. There are many places in this part of the region where streams lose water into underground channels which feed into springs downstream. Pollution of the streams could result in pollution of these underground channels and, in turn, pollution of the springs of the area.

Old strip mines or fireclay pits provide the best sites for sanitary landfills in the northern part of the Meramec Region. Because of the flat or gently sloped land in most of the section, the cut and fill trench method would also be adequate where claypits are not available, and where the soil is thick enough. Some of the deeper ravines already existing could be used as well, if properly engineered.

The thin, glade type soil in western Maries County is not sufficient to prevent the solid wastes in a sanitary landfill from polluting the water feeding into wells in the area. The trash from this area will have to be transported to sites with more suitable soil.

Climatology-- The weather has a significant effect on refuse collection and disposal since these operations are normally done outdoors. A climatological summary of the region is shown in Table 8 . Annual precipitation can be expected to vary from as little as 24 inches to as much as 60 inches. On an average, rain or snow can be expected on about 20% of the working days. Hazardous driving conditions could be expected on the average of 7 to 10 days per year. Temperatures will normally drop below freezing on 28% of the days while reaching above 90° on only 12% of the days in the year.

General Engineering Geology Units

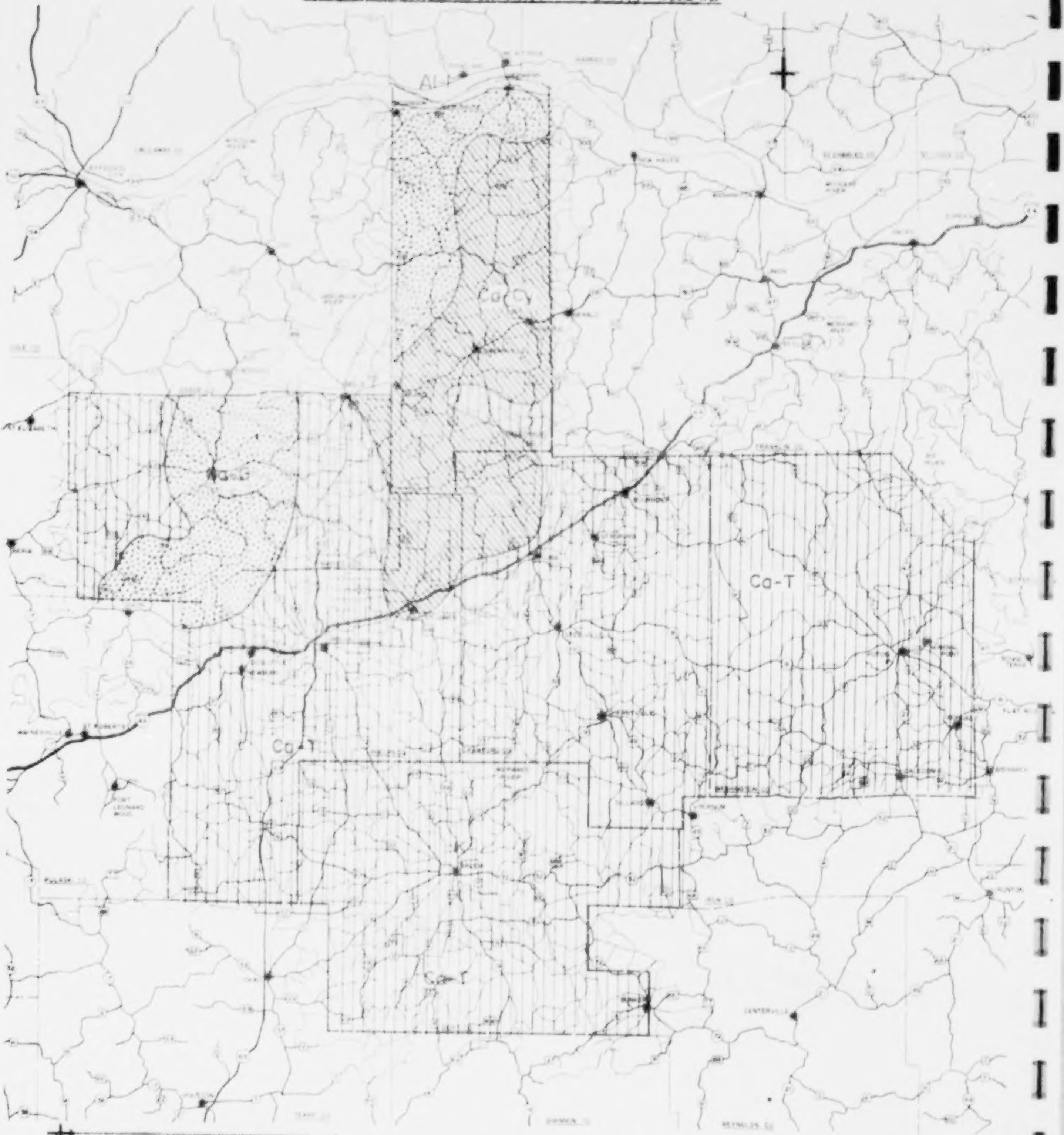

Al-L
Ca-Cy
Ca-G
Ca-T
Ca-T
K
MERAMEC REGION
PREPARED BY
MERAMEC REGIONAL PLANNING COMMISSION
SOURCE
N

Fig. 8

AL-L - Alluvial Soil
CA-CY - Carbonate & Cyclic Bedrock
CA-G - Thin Glade Soil over Bedded Carbonated Bedrock
CA-T - Thick Soil over Massive Bedrock
K - Local Karst present

Source: Engineering Geology Applicable to Sewage Treatment Locations in Missouri; Mo.G.S., 1971

TABLE 8 : MERAMEC CLIMATOLOGICAL SUMMARY

Month	Precip. Mean (in)	Snow Mean (in)	Precip. .1 in. or more (days)	Max. Temperature		Min. Temperature	
				90° and above	32° and below	32° and below	0° and below
Jan.	2.07	2.9	5	0	7	22	0
Feb.	2.29	3.2	5	0	5	21	1
Mar.	3.08	3.1	6	0	2	21	1
Apr.	3.70	0.2	7	0	0	15	0
May	5.25	0.0	9	1	0	3	0
June	5.29	0.0	7	7	0	0	0
July	3.48	0.0	5	15	0	0	0
Aug.	3.80	0.0	5	15	0	0	0
Sept.	3.46	0.0	5	7	0	0	0
Oct.	3.49	0.0	5	0	0	2	0
Nov.	2.75	1.1	5	0	1	13	0
Dec.	2.31	2.6	5	0	6	22	0
Year	40.97	13.1	69	45	21	100	2

Source: James D. McQuigg, State Climitologist, Columbia, Missouri.

A major problem in operating a sanitary landfill is wind scattering litter before it can be compacted and covered. Although the problem can't be eliminated, it can be kept to a minimum through proper design. Figure 9 is a modified wind rose for the Meramec Region. This shows, on an average, the percentage of time the wind will be blowing from a given direction. For example, during any year the wind would be expected to blow from the South-Southwest toward the North-Northeast 19.2% of the time. There would be no wind 13.6% of the time and the wind would be coming from the East-Northeast 5.8% of the time.

Landfill operators indicate that wind scatters paper most when it is blowing directly onto the fill face. If the wind is blowing from behind the face the fill works as a wind break and reduces scattering. In a trench-type landfill the fill-face will also be shielded from a cross-wind by the sides of the trench, especially if the trucks are unloaded at the foot of the fill face.

So, it makes sense to locate the fill facing the least wind, (wherever possible). In our area this would be facing the North or Northeast. When using the trench method the trench could be facing East for the most cross-wind.

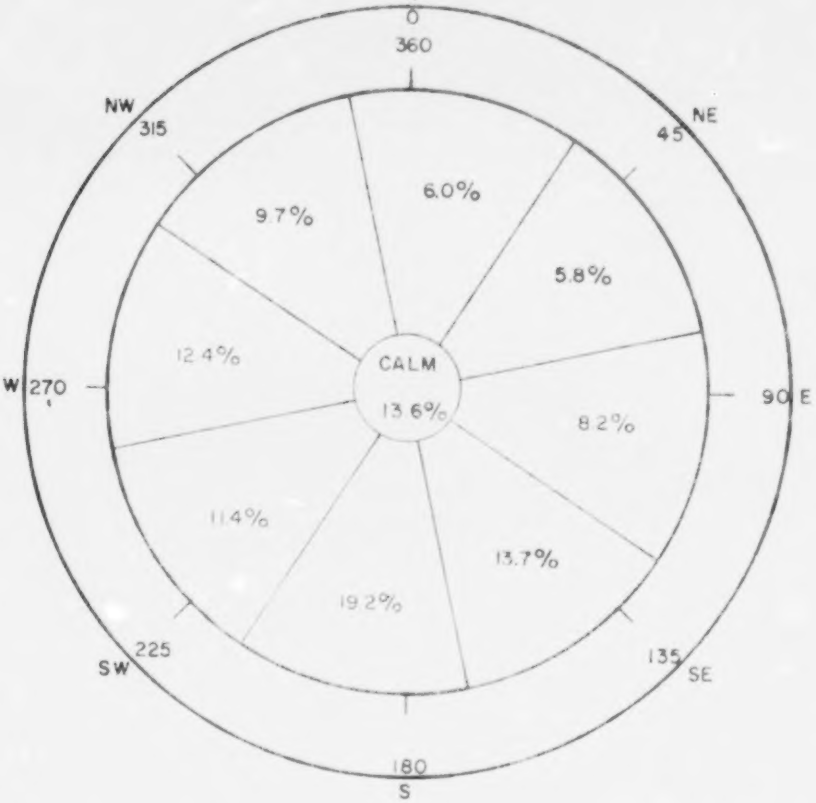
The wind rose also shows that the most effective windbreaks will be located south and west of the landfill site. Litter fences will be needed most on the north and east sides, because this is where the trash will usually be blown. If there are any odor problems at the landfill, it will probably be the down-wind neighbors to the Northeast that complain loudest.

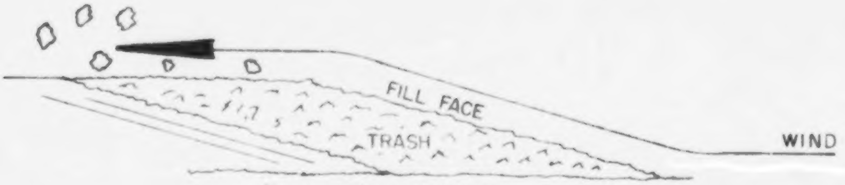
Since the strongest winds occur in early Spring and Fall it is sometimes possible to plan the landfill to avoid these winds. A contractor in the area that's filling claypits plans his landfill so he isn't finishing the top of a pit during the windy season. During March and April he operates in the bottom of a pit where the steep sides eliminate any blowing problems. Then he'll finish the top in the summer when the winds settle down.

Existing Solid Waste Management Systems-- As can be seen in Table 9 the cities are well served by refuse collectors. Only the cities of Dillard, Leasburg, and Bunker are lacking a refuse collection service. Also, the City of Belle is the only city with more than one refuse collector operating in the city limits. Fifteen cities have ordinances regulating refuse storage and collection practices, while eight city's require that everyone in the city receive refuse collection. The most popular type of service is collection of refuse at the curbside twice-per-week. Residential refuse collection charges in the cities vary from $1.50 to $2.50 per customer per month with the most common charge being $2.00 per month.

MERAMEC SANITARY LANDFILL WINDROSE

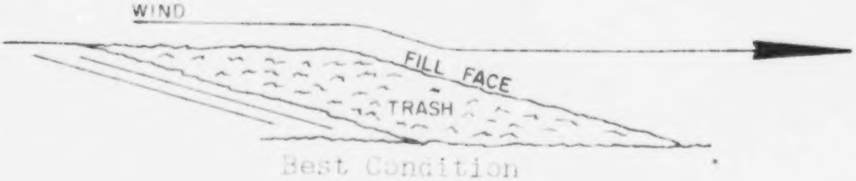
Fig. 9





FILL FACE
TRASH
WIND

Poor Condition



WIND
FILL FACE
TRASH

Best Condition

TABLE 9

SUMMARY OF SOLID WASTE MANAGEMENT PRACTICES

		COLLECTION			
Governmental Unit	1970 Population	Collection Agency	Area Served	Collection per Week	Point of Collection
1) Crawford Co.	14,828	Private	Scattered	1	Mailbox
2) Bourbon	955	Private	City	2	Curb
3) Cherryville	47	Private	City	1	Curb
4) Cuba	2,070	Private	City	2	Curb
5) Dillard	36	Individ.	--	--	--
6) Leasburg	218	Individ.	--	--	--
7) Steelville'	1,392	Private	City	1	Curb
8) Sullivan	5,111	Private	City	2	Curb
9) Dent Co.	11,457	Private	Scattered	Varies	Mailbox
10) Bunker	447	Individ.	--	--	--
11) Salem	4,363	Munici.	City	2	Varies
12) Gasconade Co.	11,878	Private	Scattered	Varies	Mailbox
13) Bland	621	Private	City	2	Curb
14) Gasconade	235	Private	City	1	Curb
15) Hermann	2,658	Private	City	2	Curb
16) Morrison	234	Private	City	1	Curb
17) Owensville	2,416	Private	City	2	Curb
18) Rosebud	305	Private	City	2	Curb
19) Maries Co.	6,851	Private	Scattered	1	Mailbox
20) Belle	1,133	Private	City	2	Curb & Bk.Yd.
21) Vienna	505	Private	City	1	Curb
22) Phelps	29,567	Private	Scattered	Varies	Mailbox
23) Doolittle	535	Private	City	2	Curb
24) Newburg	806	Munici.	City	2	Curb
25) Northwye	138	Private	City	Varies	Curb
26) Rolla	13,571	Munici.	City	2	Bk.Yd.
27) St. James	2,929	Munici.	City	2	Curb
28) Washington County	15,086	Private	Scattered	Varies	Mailbox
29) Caledonia	113	Private	City	1	Curb
30) Irondale	319	Private	City	1	Curb
31) Mineral Point	369	Private	City	1	Curb
32) Potosi	2,761	Private	City	2	Curb

TABLE 9

SUMMARY OF SOLID WASTE MANAGEMENT PRACTICES

	COLLECTION		DISPOSAL			
	Ordinances					
	Collection Regulated	Collection Required	Disposal Site Used (See Ill.#)	Engineering Plans Approved	Ownership	Operation
1)	No	No	1,2,3,23	No	--	--
2)	Yes	No	23	No	Munici.	Munici.
3)	No	No	3	No	Munici.	Private
4)	Yes	Yes	1	No	Munici.	Private
5)	No	No	Prom.Dumps	No	--	--
6)	No	No	2	No	Munici.	Munici.
7)	Yes	Yes	3	No	Munici.	Private
8)	Yes	Yes	23	No	Munici.	Munici.
9)	No	No	4,5,6	No	Munici.	Munici.
10)	No	No	6	No	Munici.	Munici.
11)	Yes	No	4	No	Munici.	Munici.
12)	No	No	7,8,9,10	No	Munici.	Munici.
13)	Yes	No	9	No	Private	Private
14)	Yes	Yes	8	No	Munici.	Munici.
15)	Yes	Yes	7	No	Private	Private
16)	Yes	Yes	9	No	Munici.	Munici.
17)	Yes	No	9	No	Private	Private
18)	No	No	9	No	Private	Private
19)	No	No	11,12	No	--	--
20)	No	No	11,10	No	Muni & Pvt	Muni & Pvt
21)	Yes	Yes	12,15	No	Muni & Pvt	Munici.
22)	No	No	13,14,15,16,17	No	--	--
23)	Yes	--	17	No	Private	Private
24)	Yes	Yes	13	No	Munici.	Munici.
25)	No	No	17	No	Private	Private
26)	Yes	No	15	Yes	Munici.	Munici.
27)	Yes	Yes	16	No	Munici.	Munici.
28)	No	No	18,19,20,21,22	No	--	--
29)	No	No	18,22	No	Private	Private
30)	No	No	22	No	Private	Private
31)	No	No	22	No	Private	Private
32)	Yes	No	20	No	Private	Private

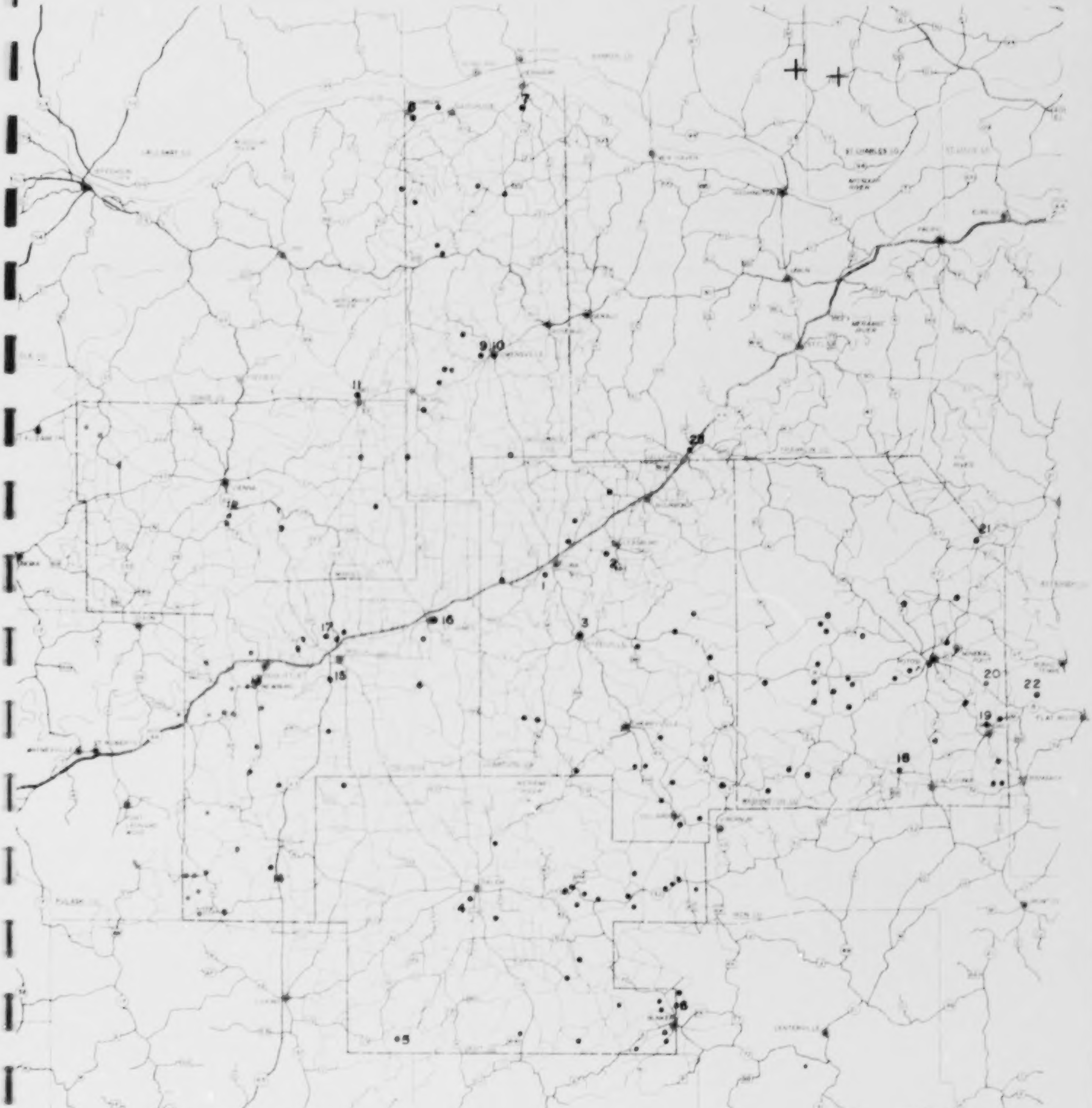
Rural collection routes exist, but are usually in the vicinity of cities or are on routes that are run once or twice per month. The charges for the rural collection service varies from $2.00 to $8.00 per month. Usually there are no fixed charges for service but are negotiated between the collector and the user. The further the user is away from the collectors regular route, the higher the cost.

Of the 20 private or publicly operated disposal sites in the Region, only the City of Rolla has an approved engineer's plan. About 60% of the trash generated in the region is disposed of in these sites. The remaining 40% is dumped in promiscuous dumps along roadsides, in streams, or on private property. A survey by the Missouri Division of Health estimates that there are over 200 open dumps in the Region. The location of some of the more prominent dumps are shown in Figure 10 .

Solid Waste Generation-- The first problem in designing a solid waste management system is finding out how much trash must be collected and disposed of. It was found that the refuse collectors have the best knowledge of waste generation. The amount of trash is not expressed in terms of pounds or cubic yards, but in the manpower and equipment required to accomplish a job. Drawing from years of experience, these men can predict daily and seasonal variations or manpower required on a new job, with a high degree of accuracy. However, this information is a judgement on their part and not readily qualifiable. For this reason, many of the collectors in the region participated in a state-wide refuse sampling program.

This sampling program was outlined by experts in this field from the U.S. Environmental Protection Agency and the Missouri Division of Health. The program consisted of weighing the refuse from 29 communities, nine of which were from the Meramec Region, during one week for four periods during the year. The results were analyzed on a computer, then the data on average waste generation was developed for rural Missouri Communities. A detailed discussion of this program is available from the Regional Planning Commission Office.

The results of the weighing program indicated that 1.75 lbs. of refuse per person per day is about the average amount of residential refuse generated in small communities. This will vary with the season from a high of 2.05 to a low of 1.45 lbs. per person per day. Combined residential and commercial refuse, as would be found in the small cities, will average 3.4 lbs per person per day and vary from 2.9 to 3.9 lbs. per person per day. For Figure 11, 3.4 lbs./person/day was used to estimate the residential and commercial refuse generation in the incorporated areas and 1.75 lbs./person/day for the unincorporated areas.


MERAMEC REGION
PREPARED BY
MERAMEC REGIONAL PLANNING COMMISSION
SOURCE
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Dump & Disposal Site Locations

Fig. 10

Source: Mo.Con.Comm., Nat'l Forest of Mo. and MRPC Surveys

It is expected that the amount of refuse collected will vary with the type of service provided, especially in the rural areas. If the refuse is collected at the user's mailbox, the average refuse collected is expected to be 1.75 lbs/person/day. If the green box system is used where smaller containers are scattered throughout the area the refuse collected could be expected to be 1.5 lbs./person/day. Whan a collection system using large centrally located containers is considered refuse collected can be expected to be one lb./person/day.

Industrial refuse generation includes only the material that is disposed of and not that which is recycled or re-used. The industrial generation rate was found to vary from 0.1 lb./person/day for Phelps County to 0.28 lb/person/day for Gasconade County. Total industrial refuse generation for the counties is shown in Figure 11.

Recreational refuse generation is not shown in Figure 11. All that is shown is the impact of the proposed Meramec Reservoir. It is obvious from the number of recreational sites , Figure 4, and seasonal homes, Table 3 , that they will generate a substantial amount of refuse, but, with existing information an estimate of how much would be little more than a poor guess. Solid waste systems for those areas will have to be flexible and it is especially important that a good record keeping system be established.

In the past the amount of trash that people throw away has been increasing at an alarming rate. Due to increases in the use of pre-packaged foods, disposable containers, newspapers, magazines, and other disposable items the average person discards more trash every year than he did last year. Refuse generation has been found to have been increasing at a rate of about two percent per person per year.

Future solid waste quantities in Figure 11 have been estimated at two rates. The first assumes that the amount of refuse per person discarded will not increase and remain the same as it is today. The second is that it will continue to increase at the rate it has in the past.

Special Problem Wastes-- Special problem wastes include hazardous wastes, junk autos, agricultural waste, dead animals, special industrial waste or any waste that cannot or should not be handled with convential refuse collection and disposal methods. The most effective solution to the problems created by special waste is to hire good management personnel that can monitor the problems and develop an effective solution before the problem gets too large. There is no waste in the area that with local initiative working on the problem cannot be properly disposed of.

During the course of this study no substantial quantities of hazardous wastes were discovered that could not be included in with the rest of the trash. However, a complete hazardous waste inventory was not made. It is expected that some of the chemical and mining industries could have waste that may be hazardous if not properly disposed of.

Although junk autos have definitely been a problem in the area in the past a solution seems to be developing. With the increase in prices paid for junk cars the landscape is becoming noticeably cleaner of old car hulks. If the price for salvaged metal remains high it is felt that there will be fewer problems in the future with auto disposal.

Very few problems were discovered with the present methods of agricultural waste disposal. As sanitary landfills are developed they should be able to handle dead animal disposal. Table 10 has been developed to provide an estimate on the number of dead animals which must be disposed of each year in the region.

TABLE 10

County	Estimated Number of Dead Animals *		
	Cattle	Hogs	Horses
Crawford	264	260	41
Dent	249	246	28
Gasconade	243	267	26
Maries	327	312	17
Phelps	274	299	31
Washington	180	181	19

There is the possibility that certain industrial wastes of some of the industries in the Region could be recycled or reused by another industry. Presently both the Regional Planning Commission and the University of Missouri-Extension Division have separate programs planned for next year to examine possible solutions to this possible problem. Considering the cost of these two projects to the taxpayers it is certain that positive progress will be made in this area.

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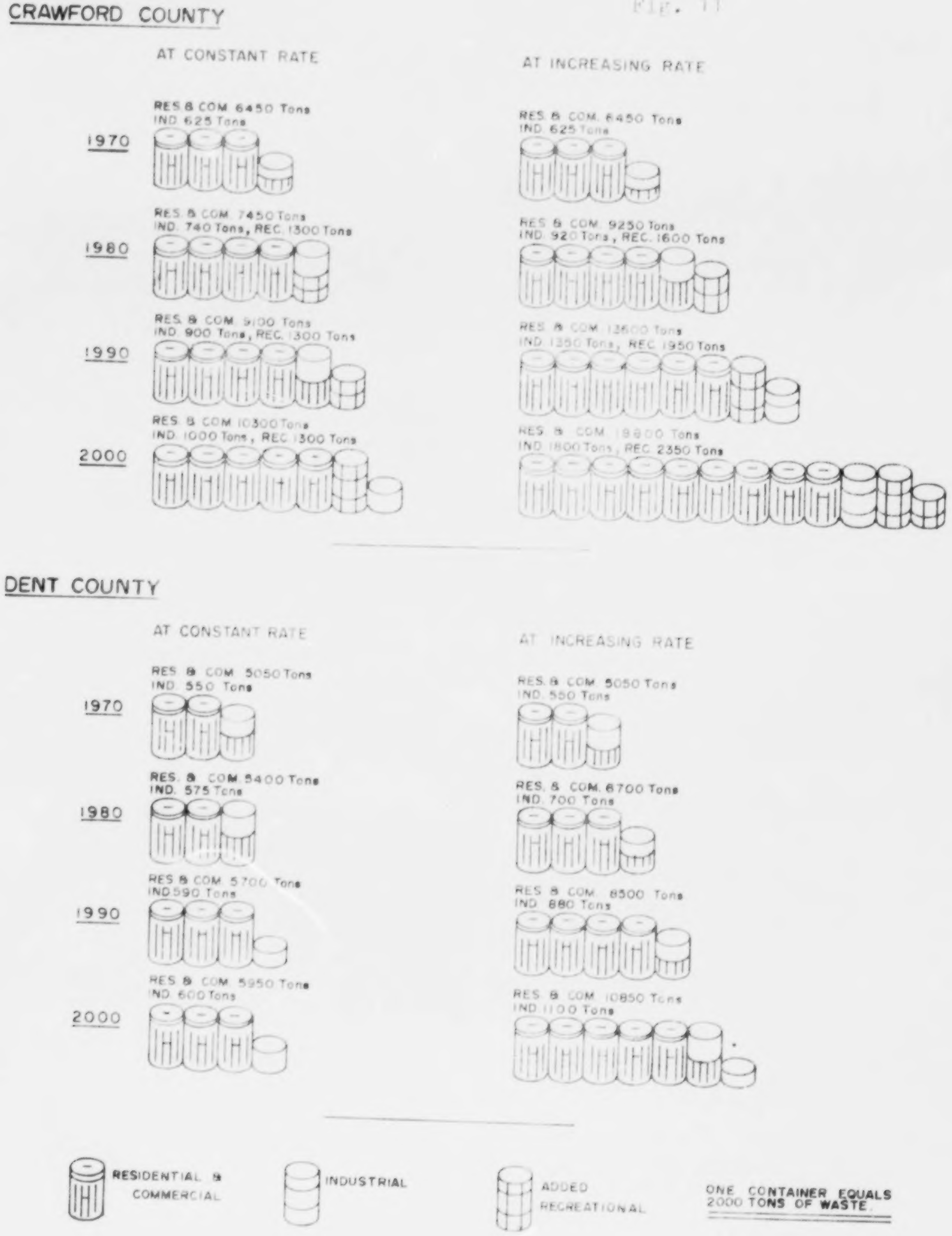
* Estimates made from information from the 1969 Census of Agriculture and the State Veterinarian

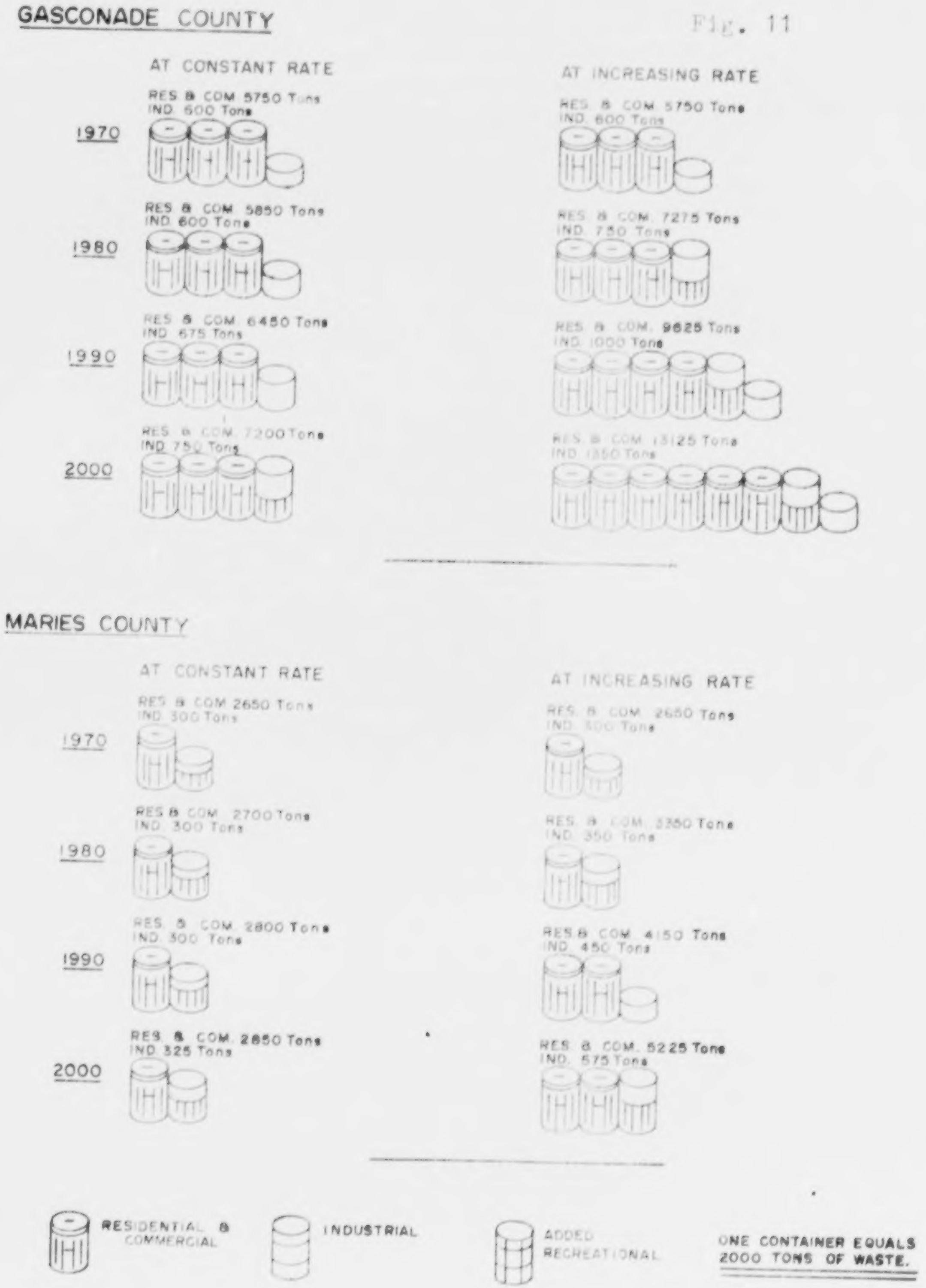
MERAMEC REGION SOLID WASTE GENERATION 1970 TO 2000

Fig. 11



MERAMEC REGION SOLID WASTE GENERATION 1970 TO 2000

Fig. 11

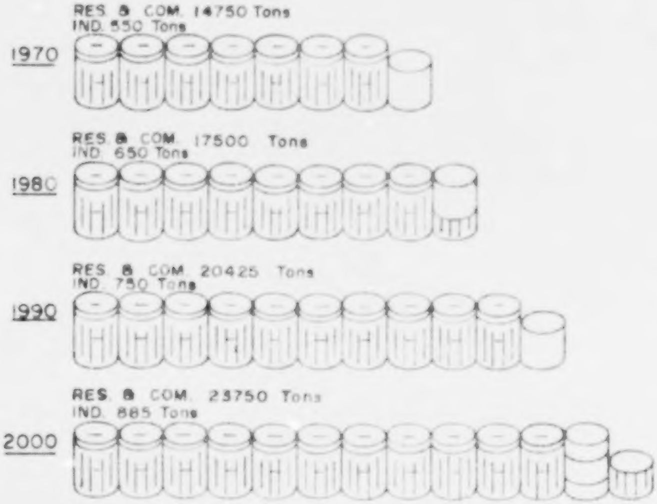


MERAMEC REGION SOLID WASTE GENERATION
1970 TO 2000

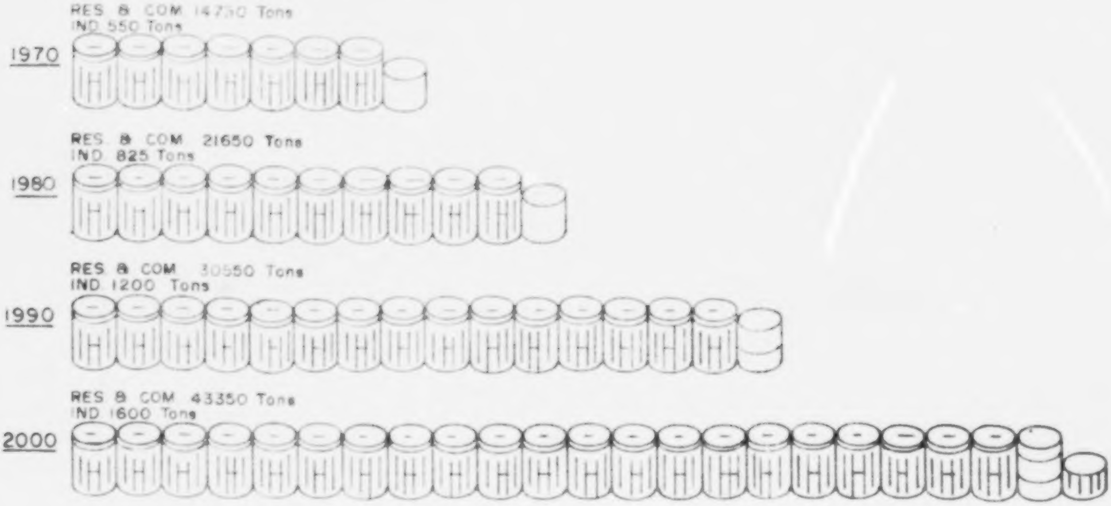
Fig. 11

PHELPS COUNTY

AT CONSTANT RATE



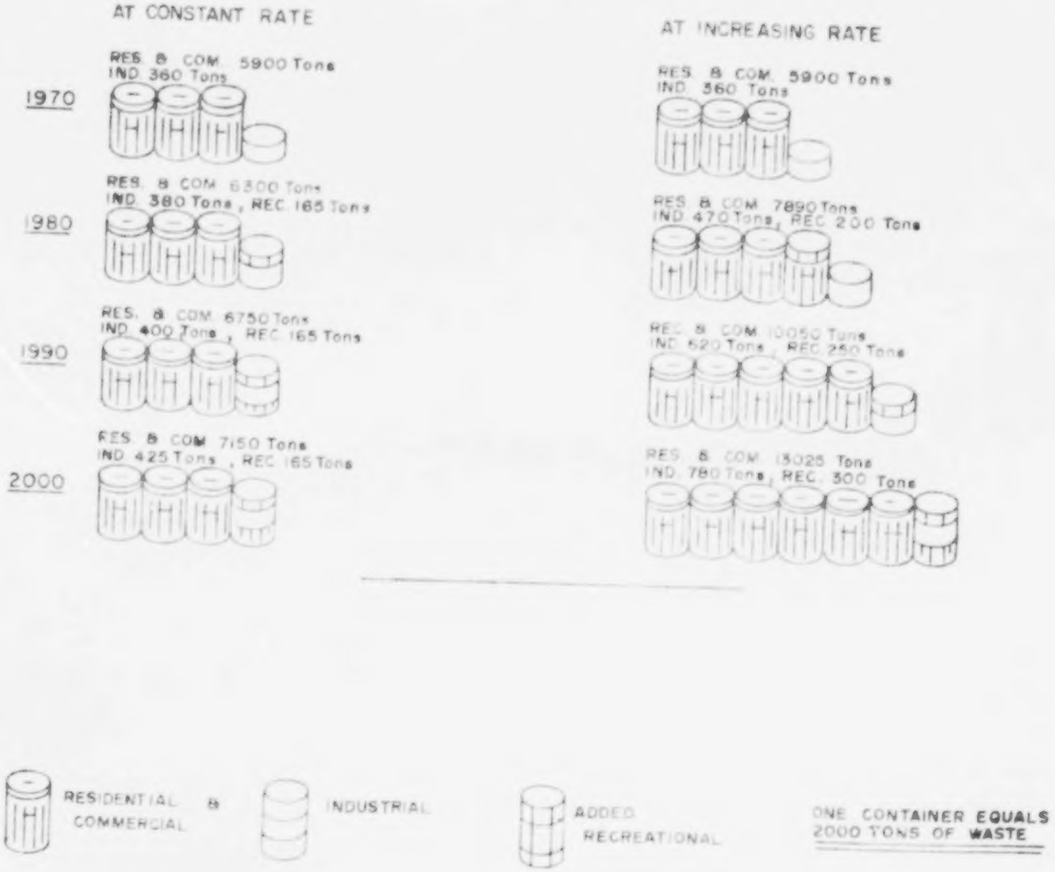
AT INCREASING RATE



MERAMEC REGION SOLID WASTE GENERATION 1970 TO 2000

Fig. 11

WASHINGTON COUNTY



Developing A Solid Waste Management Plan

Establishing Goals-- As discussed previously, all cities and counties are required by the Missouri Solid Waste Management Act to submit to the State a Solid Waste Management Plan. This law places the responsibility of providing refuse collection and disposal service on the local governments. Prior to passage of the Act the cities had the option of providing this service themselves but the counties did not have this option, even if they desired to.

The plan that each community develops will determine the type of refuse service that residents will receive and how much they will have to pay for it. Even if the system is privately contracted, it will be the responsibility of the county or city to see that it is run to the best of the public's interest.

The primary goal in developing a solid waste management plan should be to provide the services the people want at the lowest possible cost. Unfortunately, too often the goal is to do the minimum required by law.

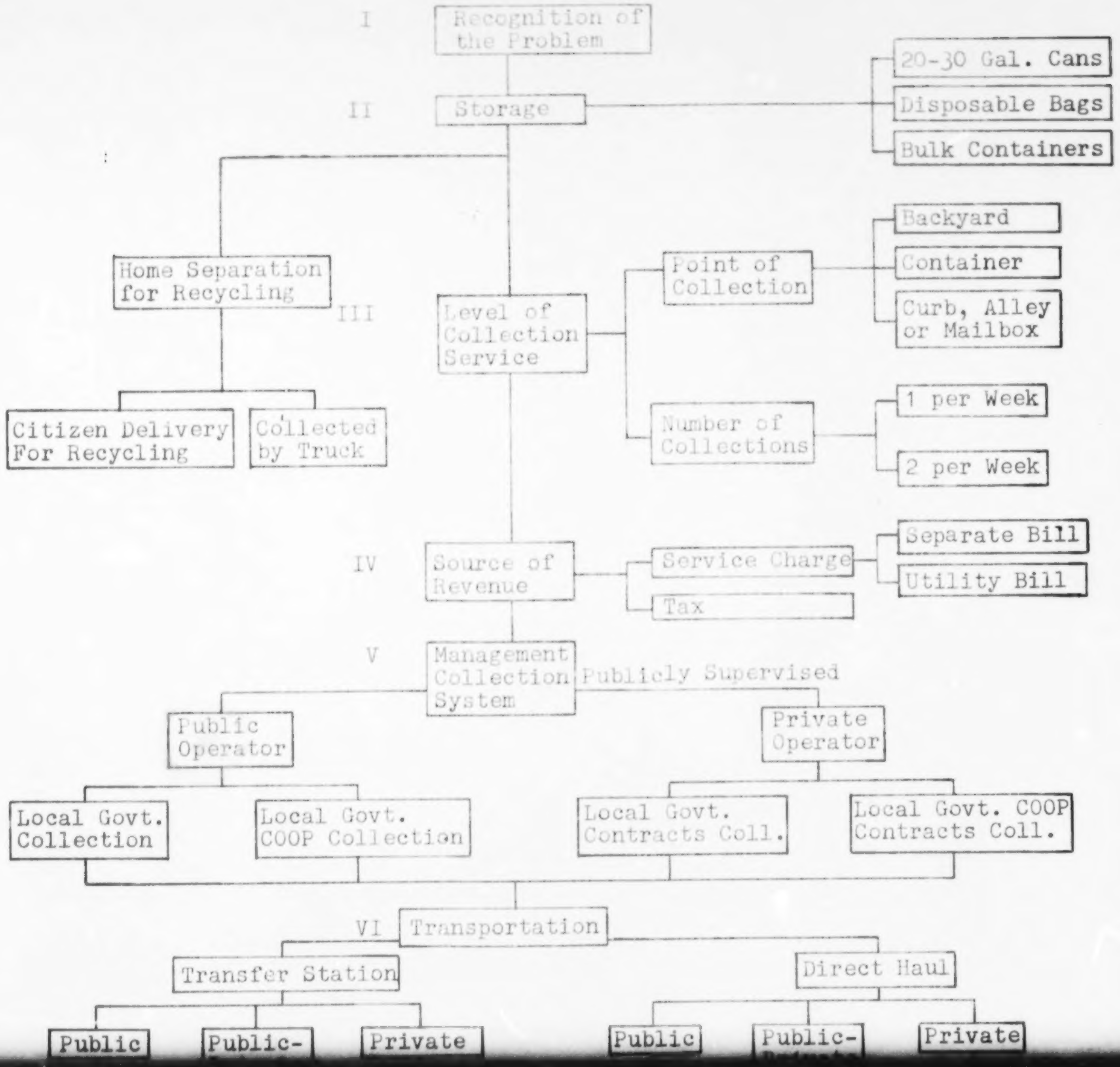
Each community in the region was found to be unique and just a bit different from their neighbors. In determining the type of services the people want the local characteristics must be considered. Besides such technical values as population densities and road conditions, community attitudes must also be taken into consideration. A countywide collection system which involves community action, like the central container system, might work very well in Gasconade County. However, people in Dent County seem to prefer individual service such as hauling their own to a landfill or mailbox collection, even though it costs more.

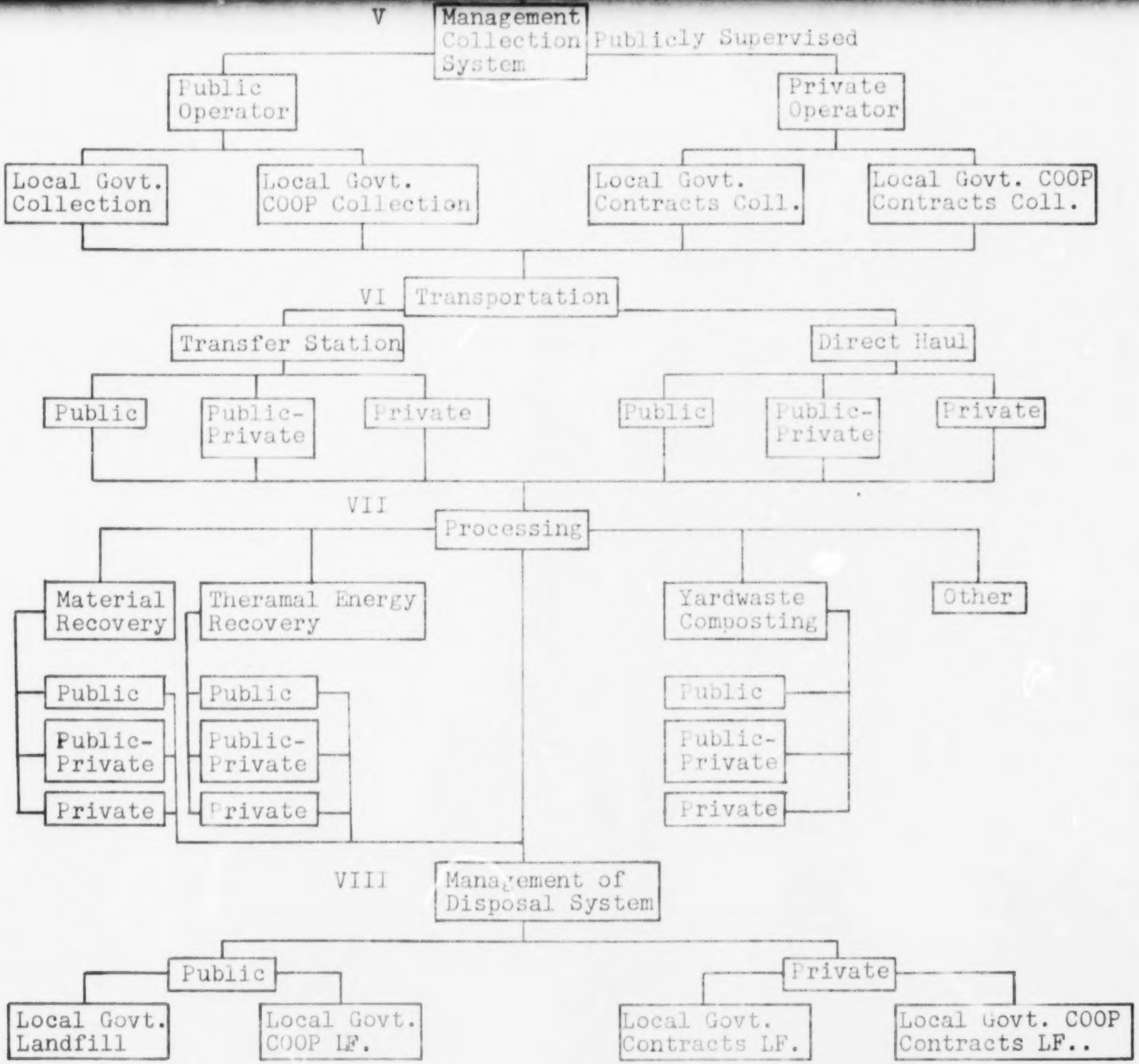
Public acceptance of the proposed system is the most important factor in developing a solid waste plan. If the people don't want the proposed system it probably will never work, no matter how strong the State or local laws are.

Decisions to be Made-- There are many decisions which must be made in developing a solid waste management system. Figure 12 and the following sections identify the major decisions and discusses some of the alternatives available. After the type of system is established an ordinance or court order must be prepared. If a private contractor is used a contract must also be developed, advertised, and let.

DECISIONS IN DEVELOPING A SOLID WASTE MANAGEMENT SYSTEM

A


I
Recognition of the Problem
II
Storage
20-30 Gal. Cans
Disposable Bags
Bulk Containers
Home Separation for Recycling
Citizen Delivery For Recycling
Collected by Truck
III
Level of Collection Service
Point of Collection
Backyard
Container
Curb, Alley or Mailbox
Number of Collections
1 per Week
2 per Week
IV
Source of Revenue
Service Charge
Separate Bill
Utility Bill
Tax
V
Management Collection System
Publicly Supervised
Public Operator
Private Operator
Local Govt. Collection
Local Govt. COOP Collection
Local Govt. Contracts Coll.
Local Govt. COOP Contracts Coll.
VI
Transportation
Transfer Station
Public
Public-
Private
Direct Haul
Public
Public-
Private


V
Management Collection System
Publicly Supervised
Public Operator
Private Operator
Local Govt. Collection
Local Govt. COOP Collection
Local Govt. Contracts Coll.
Local Govt. COOP Contracts Coll.
VI
Transportation
Transfer Station
Direct Haul
Public
Public-Private
Private
Public
Public-Private
Private
VII
Processing
Material Recovery
Theramal Energy Recovery
Yardwaste Composting
Other
Public
Public-Private
Private
Public
Public-Private
Private
Public
Public-Private
Private
VIII
Management of Disposal System
Public
Private
Local Govt. Landfill
Local Govt. COOP LF.
Local Govt. Contracts LF.
Local Govt. COOP Contracts LF..

B

DECISIONS IN DEVELOPING A

SOLID WASTE MANAGEMENT SYSTEM

Fig. 12

I. Recognition of the Problem-- The first step in setting up a good solid waste management system is to recognize any problems that exist with the present refuse system. Although these "problems" consist of anything that doesn't meet the new State requirements, a city council or county court should also determine exactly what the needs of their people are. These needs should determine the type of system developed.

One State requirement that everyone in the cities has refuse collection service often becomes controversial. Still, there is little doubt that it keeps the communities and surrounding areas cleaner. In studying collection systems in this area, it was found that a uniform collection system usually reduces the user cost about 25% over a voluntary collection system, the reason being because the collector is driving the same streets anyway. Since most voluntary collection systems serve 60 to 80% of the people, this indicates that there is very little differences in additional total cost to the community between a voluntary and uniform collection system. The main difference is that everyone is paying his fair share to keep his community clean.

A valid argument against a uniform collection system is that it can cause undue hardships on retired persons on a fixed income. To relieve this problem most cities have a provision in which part or all of the service fee can be waived by the city council or an appointed citizen's board.

The cities in the region that have implemented a uniform collection system indicate that a few people will usually protest in the beginning, but if the system is fair and economical, it will soon gain full public support. To get an idea of what the public reaction to a uniform collection system in Rolla would be the Rolla Jaycee Wives conducted a public opinion survey. To assure a valid sample a professor at the University of Mo.-Rolla was consulted on the sampling procedures. One of the questions which asked "Do you think everyone in Rolla should be required to have trash collection?" was responded to by 77.6% answering yes. Of those responding "No", many stated they felt that it would cause an undue hardship on people with a low or fixed income. This problem could be taken care of with the above mentioned provision for a waiver of fees.

The need for a uniform collection system in the unincorporated areas is less than in the cities. By state law an individual is allowed to dispose of his family's trash on his own property as long as it doesn't cause a nuisance. Obviously, this can only be done by a farmer with enough land to isolate his trash pile from his neighbor. Since over 68% of the people in the unincorporated areas of the region don't live on farms (see Table 4) there is still a definite need for some type of a rural collection system.

The savings of a uniform collection system in the unincorporated areas is even greater than in towns. According to cost projections a centrally located bulk container collection system could cost rural residents as little as $1.25 per family per month, compared to rates as high as $8.00 per month which some families are now paying for once per week voluntary mailbox collection.

One of the major problems in establishing rural collection systems in this area is the lack of local contractors. In the Meramec Region refuse service costs are about one-half what they are in the metropolitan areas. A reason for these low rates is that the hometown contractors operate a more efficient system with lower profit margins. With all the cities implementing uniform collection systems a great demand is being placed on the present contractors financial and management abilities. If contracts for county collection systems are let before the contractors have made the transition from voluntary to uniform municipal collection, they will be hesitant to bid on the systems or bid them high. If the bids for rural collection are much out of line from the municipal bids, it is doubtful that the system will ever gain local acceptance.

II. Storage-- The first decision the city council or county court will encounter is the type of storage containers to require. The three most commonly used are 20-30 gallon cans, disposable plastic or paper bags, or bulk storage containers. To meet State planning requirements the solid waste ordinance or court order must also require five items that are just good common sense. These items are:

1. Storage containers must have complete enclosures (lids).
2. Containers must be durable (either cans or bags), and specifically designed for handling solid waste.
3. Containers which must be lifted manually will not exceed 35 gallons or 75 lbs.
4. Bulk containers must have regular cleaning and maintenance. The cleaning may be done by the collector or the customer.
5. Container storage areas must be kept clean and maintained.

Cities and counties may wish to encourage recycling efforts. This requires home separating of recyclables, such as newspaper, bottles, and cans, from the rest of the trash. Collection can either be by citizens voluntarily bringing the recyclables to a recycling center or by collecting them by truck. If a large scale recycling program is being considered, the economics should be thoroughly examined before commitments are made.

Some of the advantages and disadvantages of the three types of storage systems are listed below.

A. 20-30 gallon trash cans
  1. Advantages
    a. most commonly used
    b. most compatible with backyard collection
    c. reasonable size
    d. economical

  2. Disadvantages
    a. must be be cleaned regularly
    b. rust or crack

B. Disposable Bags
  1. Advantages
    a. easier to handle
    b. reduces spillage and blowing litter when loaded into truck and at landfill
    c. no cans left at curb
    d. reduces contact with waste
    e. most compatible with curbside collection

  2. Disadvantages
    a. per bag cost is high
    b. bags sometimes break
    c. torn by animals
    d. may be difficult to obtain bags.

C. Bulk Containers
  1. Advantages
    a. compatible with large commercial generators
    b. compatible with county or small town collection
    c. economical
    d. efficient

  2. Disadvantages
    a. residents must carry refuse to container
    b. difficult to properly size and locate containers

III. Level of Service-- The next decision that the city council or county court must make is the type of service the people in the community want. The three most common levels of service is for the refuse to be collected at the residents backdoor; curb, alley, or mailbox or at a bulk container site. It will also need to be determined if refuse will be collected once or twice per week. Since people usually resist a change, the most popular type of service will probably be what is presently being offered.

Some of the advantages and disadvantages of the different levels of service are listed below:

- A. Point of Collection
    - 1. Backyard
        - a. advantages
            - i. less effort required by citizen
            - ii. no cans at curb
        - b. disadvantages
            - i. more expensive
            - ii. collectors must trespass
            - iii. collector must remember where each can is kept
    - 2. Curb, Alley, or Mailbox
        - a. advantages
            - i. less expensive
            - ii. labor and energy efficient
            - iii. compatible with use of bags
            - iv. compatible with source separation
        - b. disadvantages
            - i. cans left at curb
            - ii. special arrangements must be made for handicapped
    - 3. Bulk Containers - same advantages and disadvantages as in storage.

IV. Source of Revenue-- Service charges are by far the most used source of revenue in the region to pay for solid waste management services. The service charges can either be collected by a separate billing or by adding it to the city utility bill.

There are some taxes which cities and counties can use to provide all or part of the revenues such as the special tax levy authorized in the Missouri Solid Waste Management Act. A maximum of 10¢ per $100 assessed evaluation can be approved by the voters. Third Class cities can also authorize a 20¢ per $100 assessed evaluation tax for public health purposes. Cities can also impose a franchise tax, which will be collected by the utility companies, and use this revenue for solid waste purposes. This tax has no legal limit, but seldom exceeds 15% of the utility bill. Some cities also use sales tax revenues to supplement the solid waste managmment system. General revenue funds can also be used for financing, but few local governments have a surplus of those funds.

Revenue sharing funds can be invested in the solid waste management system to pay for initial operating expenses. A well managed system can provide an excellent return on such an investment. Initial operating expenses can also be financed with general obligation bonds or through private financing, such as a bank.

The Farmers Home Administration has loan funds available at 5% interest to local governments and certain not-for-profit corporations for solid waste facilities. There are also guaranteed loan programs available from the Small Business Administration, and the Farmers Home Administration. Some of the advantages and disadvantages of the different sources of revenue are as follows:

A. Service Charges
   1. Advantages
      a. does not need voter approval
      b. all city utilities can be discontinued for lack of payment
      c. more fair, user is paying for service received
      d. encourages good management, user knows what service is costing

   2. Disadvantages
      a. counties and cities without utilities must make special billing
      b. counties and cities without utilities must take court action to collect bad debts

B. Taxes
   1. Advantages
      a. can use existing billings in all areas

   2. Disadvantages
      a. unfair, cost does not represent service received
      b. same taxes require voter approval
      c. cost cannot exceed maximum tax rate
      d. not everyone in the county receives a tax bill

V. Operation of the Collection System-- The cities and counties have the option of operating a publicly managed collection system or contracting it with a private contractor. A publicly managed system can be operated by a local government serving only themselves; one government can contract to serve neighboring governments, or it can be operated jointly by several local governments. To establish a sound management agency with the joint governmental approach, a non-profit corporation needs to be formed. The board members of the corporation can be made up of the local elected officials.

If private contracts are sought, each government can let its own contract, neighboring governments can let a joint contract, or the non-profit corporation can be formed to let and supervise the contract.

To meet the State planning requirements the following items must be included in the ordinance or court order:

1. Everyone in the municipalities participate in the refuse collection service;
2. Garbage is collected at least once per week;
3. Community bulk containers are serviced at least twice per week;
4. No limit on the amount of residential waste removed;
5. Provisions for bulky waste collection;
6. Collection vehicles are to have enclosed, leak-proof bodies;
7. In the municipalities backyard burning of trash prohibited.

Some of the advantages and disadvantages of public or private operated systems are listed below:

A. Publicly Operated Systems
   1. Advantages
      a. tax free
      b. non-profit
      c. local government has administrative control
      d. low interest loans available

   2. Disadvantages
      a. lack of incentive to maximize efficiency
      b. monopolistic

B. Privately Contracted System
   1. Advantages
      a. self-financing
      b. competition may reduce cost
      c. can cross political boundaries to gain economy of scale

   2. Disadvantages
      a. less administrative control
      b. local government still has responsiblilty to see that proper service is provided

VI. Transportation-- Some communities have found they can reduce their transportation cost by installing transfer stations. This is when the refuse trucks are unloaded into a compactor mechanism which compacts the trash into a larger truck. With one trip to the landfill, the larger truck then replaces several trips of the smaller trucks. The main problem with a transfer station is that an additional expensive step is added to the solid waste management system. Since this area has lower wage rates, a good transportation network, and lower per capita waste generation, a transfer station would be very hard to justify economicly.

The distance that it is economical to direct haul refuse is different for every situation. For example, a 30 mile one-way haul distance is usually considered excessive. For the City of Vienna, however, it is quite feasible. Vienna is small enough that with a proper sized truck all the communities refuse can be collected on one load. There should also be sufficient capacity for the collector to service households along the route from Vienna to a landfill at either Rolla, Owensville, or Dixon. Since he is making a productive haul he can travel until he fills his truck or runs out of customers.

Since there are so many small communities in the region, it is difficult to schedule crew loads where they are productive all the time. For example, the City of Salem probably doesn't need two full-time crews to collect all the refuse in the city, but the job definitely can't be accomplished with just one crew. The excess time of the two crews could either be spent on a rural collection route or by hauling to a larger, more economical landfill.

Each community must look at its individual situation and explore each alternative available as it applies to its community. The use of "rule-of-thumb" figures usually apply to other areas and seldom illustrates the most economical alternative for this area.

VII. Processing-- The term "processing waste" applies to some of the more sophisticated methods of refuse handling such as compacting, landfilling of baled waste, materials recovery, sanitary landfill of shredded waste, or incineration for energy recovery.

With the closing of the local dumps and increased hauling distance to a central landfill, many cities should consider starting a community compost pile with leaves and yard waste. All that is necessary is a vacant lot, a limb chipper, and equipment to occasionally turn the pile. The maintenance of the compost pile could be turned over to a Garden Club.

In addition to reducing material that must be hauled to a landfill, the city will be providing a valuable soil conditioner to gardeners.

Other forms of refuse processing will be more difficult to justify. The economies of materials recovery will be hard to justify due to the relatively small quanity of recoverable waste and high transportation cost to get the recovered material to the purchasers.

Voluntary recycling efforts aid in both improvement of community attitudes and slows down the drain of our natural resources. These efforts should be encouraged in the communities. If a municipal or county operated recycling program is being considered the economics should be thoroughly investigated before commitments are made. Since the price paid for recycled material is constantly changing, the feasibility of such a project should be occasionally reconsidered.

Energy recovery of shredded waste by incineration seems to have potential as a long-range solution to the solid waste problem. Such a project here could consist of building transfer stations and transporting this waste to the Proposed Union Electric Energy Recovery Unit in St. Louis. Another potential project would be burning the refuse in an existing local boiler, such as the Power Plant at the University of Missouri-Rolla. Further research is necessary on both projects and they should be given consideration as they develop.

VIII. Operation of the Disposal System-- As with the collection system, cities and counties have the option of a public or privately contracted disposal operation. The need for cooperation between cities and the county is even greater with the disposal system than it is with the collection system. Studies in this area show that to operate a sanitary landfill at $5.00 a ton disposal cost, a minimum population served of 10,000 is necessary. This indicates that the landfill should serve an area at least the size of a county. The formation of a non-profit corporation to serve as a management agency gives every community a voice in the operation of the disposal site.

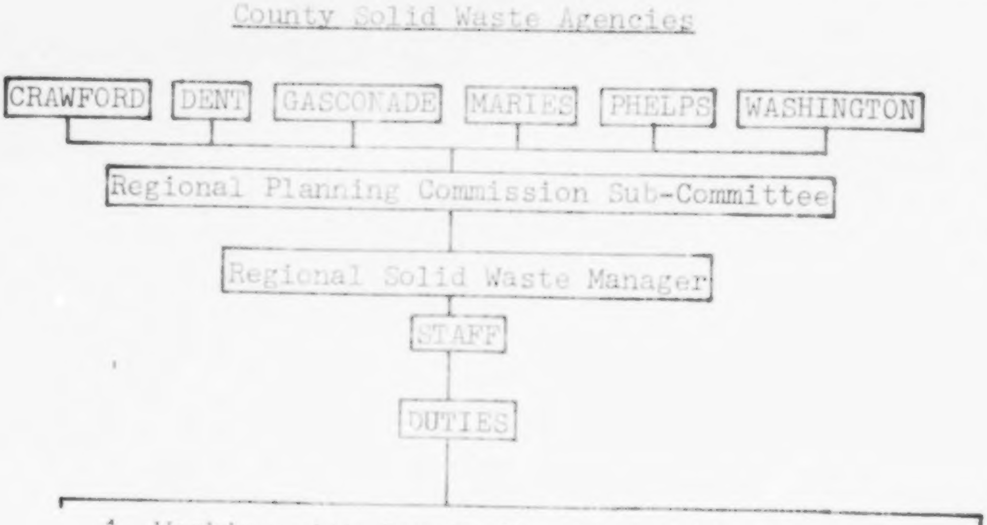
Area-wide Management System-- An alternative not shown in Figure 12 is that of an areawide management system. However, the need for the best management decisions to be made at the right time will be the most important element of the proposed refuse system. Unless the proper decisions are made, the refuse collection and disposal operation will undoubtedly grow more costly.

Garbage collection most always takes the backseat in popularity to other municipal and county services such as street and road maintenance, law enforcement, fire protection or even water and sewer service. So usually, councilmen find little prestige in being chairman of the sanitation committee and this can lead to neglecting the all important management system.

One problem with good management is that it is expensive, and it is doubtful that a county system would keep a manager completely busy. However, a manager could be hired by the administrators of several of the county systems. The bookkeeping and many of the problems encountered would be similar for each of the refuse systems. The manager would take care of the day-to-day operations of the refuse collection and disposal system and report to the city, county, or county board for administrative decisions. An organizational chart showing a possible framework for such a system is shown in figure 13 .

Fig. 13

REGIONAL MANAGEMENT SYSTEM ORGANIZATION CHART


County Solid Waste Agencies
CRAWFORD
DENT
GASCONADE
MARIES
PHELPS
WASHINGTON
Regional Planning Commission Sub-Committee
Regional Solid Waste Manager
STAFF
DUTIES

1. Working with County Courts and City Councils to develop appropriate Court Orders, Ordinances, and Contracts which pertain to the solid waste management system.
2. Obtain capital financing.
3. Establish billing system.
4. Perform routing analysis to determine the most efficient collection truck and crew sizes.
5. Assist the contractors to provide the most efficient service to the public.
6. Establish a management information system to provide the data necessary to make the best management decisions in the future.
7. Locate processing or disposal sites.
8. Obtain all necessary State and Federal Permits.
9. Supervise collection and disposal crews.
10. Maintain Financial records.

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CRAWFORD COUNTY SOLID WASTE MANAGEMENT PLAN

Background

Purpose-- This plan has been written to ensure that every resident, business, and industry of Crawford County has a method of properly disposing of their trash and garbage. When implemented there will be no need for rat-infested, open-burning dumps, and no excuses for people dumping their trash along the roadside, on someone else's property or in the rivers of Crawford County. This plan is also intended to meet the planning requirements of the Missouri Solid Waste Management Act of 1972 for Crawford County and the cities of Bourbon, Cuba, Leasburg, and Steelville.

Background Data-- Population and housing data from the 1970 Census and MRPC Surveys is listed in Table C-1 for Crawford County and the cities in Crawford County.

TABLE C-1

CRAWFORD COUNTY HOUSING DATA

	Population	Occupied Housing Units	Persons/ Housing Unit	Housing Unit with 1 Person	Est'd no.of Business	Industries
Crawford Co.	14,828	4,954	3.0	926	--	--
Unincorporated	9,135	2,869	3.2	383	38	8
Bourbon	955	332	2.8	74	41	5
Cuba	2,070	791	3.6	213	88	10
Leasburg	218	91	2.3	38	8	1
Steelville	1,392	511	2.5	180	60	7
Sullivan (Crawford Co.part)	1,058	320	3.3	38	N.A.	N.A.

Solid Waste Steering Committee-- The elected administrative officials in Crawford County have recognized the need for a good solid waste managment system. Since refuse collection and disposal are problems common to both the cities and the county, both have been working together to find the most economical solution. A County Solid Waste Steering Committee has been formed with the membership composed of the Mayors of the four cities and the Presiding Judge. Representatives from the Regional Planning Commission have served as ex-officio members.

The county committee was responsible for reveiwing the alternatives available and developing the framework of the County Solid Waste Management Plan. By working as a group they have been able to recognize and deal with the problems that cross the city limit lines. They will also be a large enough unit to take advantage of economie of scale which they couldn't individually.

All four cities are relatively small, yet, with the improvement of I-44 between Crawford County and the St. Louis Metropolitan area and the increased mining activity in the new lead belt area, the entire county is expecting industrial growth. Also, if the proposed Meramec Park Reservoir is built, Crawford County will be faced with serious economic changes. The plan developed has to serve the present predominantly rural communities, yet be flexible enough to accomodate severe changes in the county.

Recommendations of the Committee

Management-- A not-for-profit corporation is being formed to serve as a County Management Board. Board members will consist of the Mayor of each of the four cities and the Presiding Judge. Each member will have one vote in the corporation. The Board will contract for refuse collection and disposal services with each of the cities and the county. One county contract will be let by the board for the county refuse collection and disposal operation. Existing contractors will be encouraged to submit a combined bid. Enforcement of the ordinances and court orders will be the responsibility of the respective Mayor or Presiding Judge.

Storage-- On-site storage of solid waste will be regulated by city ordinances in the incorporated areas and court orders in the unincorporated areas. The ordinances and court orders will be developed to meet the State requirements previously mentioned pertaining to container design and sanitary condition, which are listed on page 55.

Collection-- Each household, business, and industry in the four cities will be required to have refuse collection services. A minimum of once-per-week curb-side collection will be required. Refuse collection in the incorporated areas will be regulated by city ordinance and will meet the requirements established by the State, which are listed on page 59.

Residents in the unincorporated areas of the county will be given three options. The first is for residents to dispose of their own waste on their own property as long as they meet the requirements of the Missouri Solid Waste Management Act. The second option will be for individuals to bring the refuse to one of the centrally located bulk container sites. They will be allowed to dump their waste without an on-site dumping charge. The final option will be for the individuals to subscribe to the once-per-week mail-box collection service. Rural collection routes will be established wherever they are deemed feasible by the County and the contractor. The operation of the collection system in the unincorporated areas will be regulated by the County Court Order and will meet the sanitary requirement of the State, which are listed on page 59.

Disposal-- Disposal of all solid waste will be in a sanitary landfill leased or owned by the Board and operated by the contractor. Abandoned fire-clay pits are being considered as land reclamation projects to serve as the landfill sites. The contractor will be required by the Board to meet all state regulations for operation of a sanitary landfill. There are sufficient claypits in the area to last well beyond a ten year period. It is hoped that in addition to reclaiming wasteland by using claypits, that a broader range of special problem waste can also be properly handled. A list of materials accepted at the landfill will be provided with the engineer's plan on the site.

As the Energy Recovery from Solid Waste Projects are established, the Board will consider the feasibility of establishing transfer stations and transporting the waste to these projects.

Financing-- The Solid Waste Steering Committee felt that one of the most important factors in the implementation of this plan would be public acceptance. If the people would accept the plan they would also vote for it, so the solid waste levy authorized by state law will be placed on the ballot during the primary election in August. If this tax is passed it should bring in sufficient revenue to operate the landfill and provide for collection of the bulk containers.

Persons in the incorporated areas will only be charged for refuse collection service and they will be billed on their City Utility Bill. Invididuals requesting county mail-box collection will also only be charged for the collection cost and will be billed by the County or its duly authorized agent.

Alternate Plan-- If the solid waste levy fails to pass, the Board will enter into disposal contracts with the proposed landfill in either Phelps, Gasconade or Franklin Counties. Individuals in the cities and those electing county mail-box collection will be charged the entire cost of collection and disposal, plus the increased cost of transportation to the more distant landfill. The option in the county of the bulk container service will be dropped until the tax is accepted by the voters.

Future Plans-- It is intended to make a time and waste generations study of the collectors routes after they have had time to become stable. Data from this study will become part of the future plans for Crawford County. A good management information system will be especially important in Crawford County since this area could be experiencing considerable growth in the near future.

The County Court will continuously monitor the effectiveness of the rural solid waste management system. If they feel it is not sufficiently abating open dumping, appropriate modification in the system will be made.

Implementation Schedule

July, 1974-- Solid Waste Management Plan adopted.

August through December, 1974-- Solid Waste Levy will be placed on the ballot. All cities will have adopted uniform collection ordinances and contracted for refuse collection service as outlined in the Committee Recommendations. The County Court order previously mentioned will have been adopted regulating sanitation of refuse collection operation in unincorporated area.

January, 1976-- The revenue from Solid Waste Tax will begin and the County-Wide Sanitary Landfill and bulk container sites begin operation. All the dumps in the county will be closed.

July 1974 through July 1984-- As contracts come due the same high level of standards as outlined previously in the plan will be maintained.

Solid Waste Management System Design

Municipal Collection-- The cities of Cuba and Steelville have had uniform collection systems in operation for several years while the City of Bourbon has a well established voluntary collection system. The present systems provide excellent service for a reasonable cost. With the exception of all cities adopting a uniform collection ordinance, few improvements are necessary in the collection system.

Rural Collection-- Voluntary refuse collection is available in most of the subdivisions and mobile home courts in the unincorporated areas of the county. However, with the implementation of the County Solid Waste Management Plan, the mailbox collection system would be expected to greatly expand. In order to get an idea of what an acceptable service charge would be, a system design and a typical annual budget was prepared.

Mailbox Collection Design Data-- Very little design data could be found for rural mailbox collection systems, so the data had to be developed first hand. Time studies were run on the existing rural collection systems in Crawford County. The most efficient system was found to be a one-man crew operating a ten cubic yard compactor. For this type system the average time per stop was found to be slightly less than one minute, with the average speed on the route being 20 mph, and average speed off route being 40 mph. Time to unload at the disposal site was 15 minutes.

Mailbox Collection Routing Analysis-- Since it isn't possible to estimate how many people will subscribe to the county mailbox collection service, two routing analysis were made. The first assumed that fifty percent of the residents along the route would subscribe; the second assumed 70%. The routes were designed in a loop pattern to minimize deadhauls and radiated from the cities of Bourbon, Cuba and Steelville. Load capacity of the 10 cu.yd. truck was calculated as follows:

2.25 lb/person/day x 3.2 pers/houshold x 7 days = 50 lbs/household/week

10 cu.yd. x 700 lbs/cu.yd. ÷ 50 lbs = 140 households per route

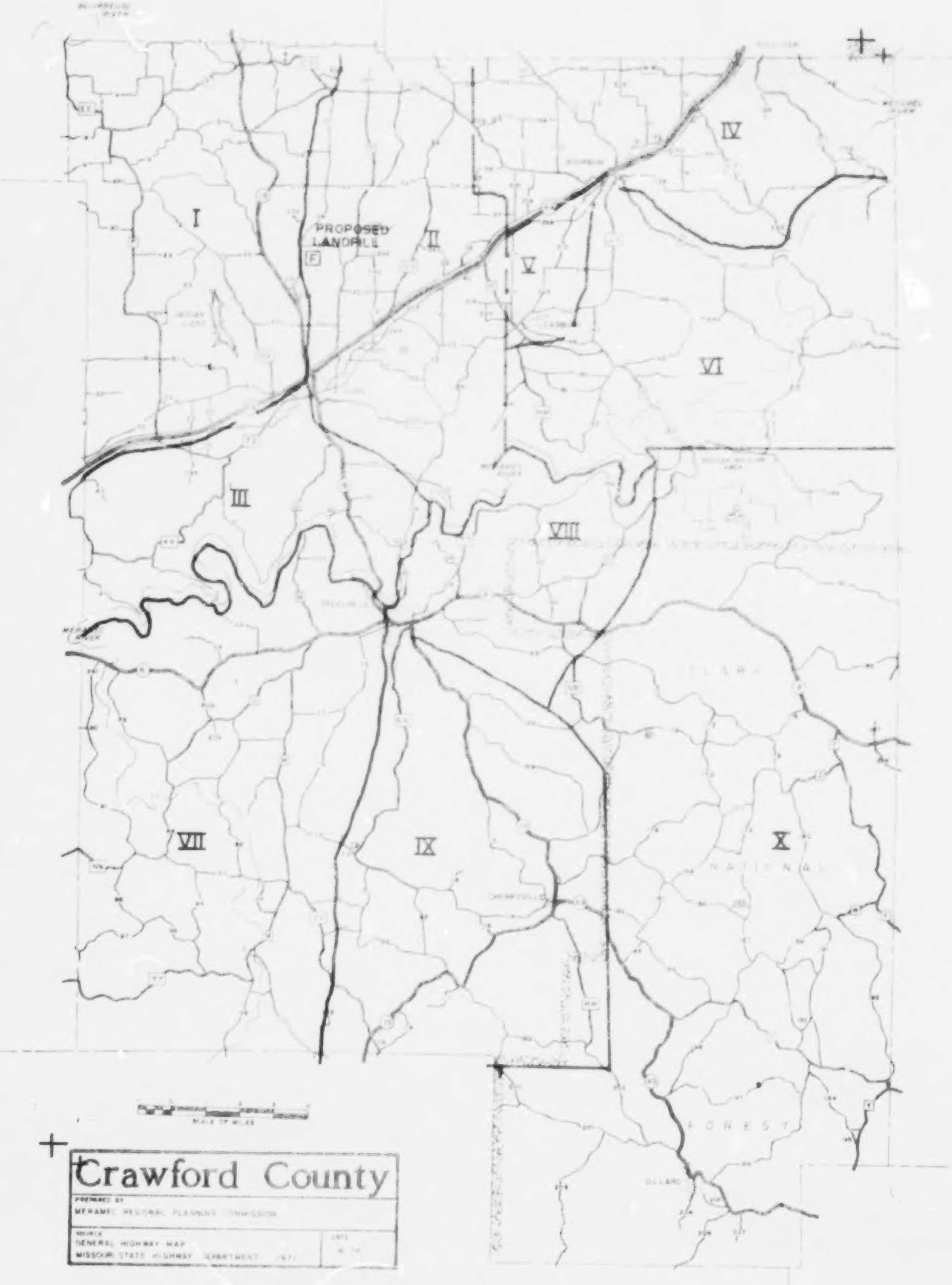
Ten routes were found necessary with 50% participation. Figure C-1 indicates the area served on each route. Detail maps showing the roads traveled on each route are available at the Regional Planning Commission Office. Table C-2 indicates the time required to complete each route, including the trip to the landfill and return to the point of beginning.

Assuming 70% participation, it was found that sixteen routes would be necessary. The routes are shown in Figure C-2 and a time summary in Table C-3.

Mailbox Collection Typical Annual Cost-- The routing analysis indicates that 67 hours per week would be required to service the unincorporated area if 50% of the people subscribed, and if 70% subscribed, 83 hours would be required. If two crews were used with 50% participation, there would be 13 hours work time left over each week for truck maintenance and extra time that may be required on route. Since the 50% participation assumption fully utilized a unit of two collection crews it will be used to get an

Rural Route Areas - 50% partipation

Fig. C-1



I
II
III
IV
V
VI
VII
VIII
IX
X
PROPOSED LANDFILL
NATIONAL
FOREST
SCALE OF MILES
Crawford County
PREPARED BY
MERAMEC REGIONAL PLANNING COMMISSION
SOURCE
GENERAL HIGHWAY MAP
MISSOURI STATE HIGHWAY DEPARTMENT 1971
DATE

TABLE C-2

CRAWFORD COUNTY MAILBOX COLLECTION SYSTEM ROUTING ANALYSIS

ASSUMING 50% PARTICIPATION

Area	Miles on Route	Houses on Route	Houses Served	Time Required (Hrs)
I	72	285	143	7
II	67	290	145	6.5
III	51	307	154	6
IV	73	296	148	7.5
V	24	140	70	3.5
VI	39	204	102	6.5
VII	77	300	150	7.5
VIII	45	282	141	6
IX	59	268	134	7
X	101	325	163	9.5
TOTAL	---	---	1350	67

Rural Route Areas - 70% participation

Fig. C-2

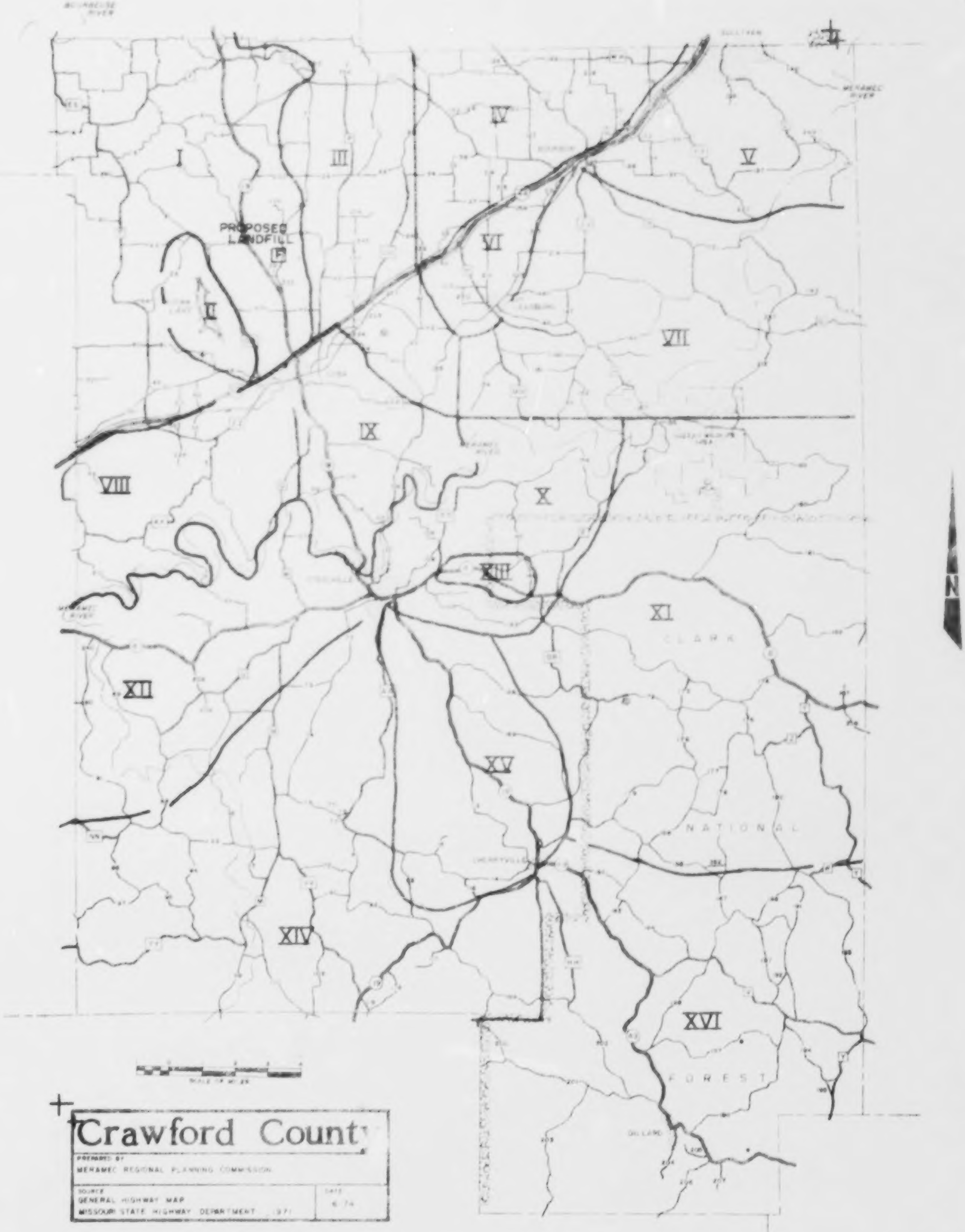

BOURBEUSE RIVER
SULLIVAN
MERAMEC RIVER
I
II
III
IV
V
VI
VII
VIII
IX
X
XI
XII
XIII
XIV
XV
XVI
PROPOSED LANDFILL
L
STEELVILLE
CHERRYVILLE
DILLARD
CLARK
NATIONAL
FOREST
N
SCALE OF MILES
Crawford County
PREPARED BY
MERAMEC REGIONAL PLANNING COMMISSION
SOURCE
GENERAL HIGHWAY MAP
MISSOURI STATE HIGHWAY DEPARTMENT 1971
DATE
6-74

TABLE C-3

CRAWFORD COUNTY MAILBOX COLLECTION SYSTEM ROUTING ANALYSIS

ASSUMING 70% PARTICIPATION

Area	Miles on Route	Houses on Route	Houses Served	Time Required (Hrs)
I	53	201	140	5.5
II	19	84	59	3
III	49	200	140	5.5
IV	47	214	150	6
V	26	82	58	3.5
VI	24	140	98	4
VII	39	204	143	7
VIII	35	197	138	5
IX	37	207	145	5
X	29	126	88	4.5
XI	45	156	110	6
XII	41	140	110	5
XIII	17	154	108	4
XIV	53	221	155	7
XV	40	213	149	6
XVI	45	168	118	6
TOTAL			1909	83

idea what the typical cost might be. Naturally, if the participation rate is higher, the cost would be expected to be lower. The typical annual cost is shown below.

Typical Annual Cost Mailbox Collection

	Initial Cost	Annual Cost
I. Equipment Investments		
2-10 cu.yd. Compactor Trucks	$ 24,000	$ 6,012*
II. Personnel		
2-Drivers-Collectors @$3.50/hr. Adjusted**		$18,214
III. Operating Cost		
Gasoline - 3640 hrs x 2.3 gallons x 60¢		$ 5,024
Maintenance Repair Labor-$.50/op.hr. Repair Parts-$1.00/op.hr. = $1.50 x 3640 hrs. .		$ 5,460
Uniforms & Safety Equipment		$ 900
Lot Rental ($200/month)		$ 2,400
Insurance		$ 1,000
Miscellaneous		$ 800
TOTAL ANNUAL COST		$39,810

*Annual Cost computed on 5 yr. life @ 8% interest.
**Includes Social Security, Hospitalization, Workman's Compensation, Vacation and Sick Leave.

Mailbox Collection Monthly User Cost-- The monthly cost for refuse collection service is calculated as follows: $39,810/1350 users/12 months = $2.46 per month. In addition to this cost there should be a charge for management and billing, which usually runs 25¢ to 50¢ per month. The disposal cost would be payed for by the tax, so the total monthly bill for county mailbox refuse collection should be between $2.75 to $3.00 per user per month.

Crawford County Sanitary Landfill-- There will be no need for the landfill to be open to the general public. With uniform collection in the cities there will be no need for individuals to go to the landfill. In the unincorporated areas individuals will dispose of their refuse either on their own property, take it to a bulk container or have it collected at their houses. Keeping the public off the disposal site should reduce the cost of operating the landfill. The typical annual cost of the landfill is shown below:

Crawford County Sanitary Landfill
Typical Annual Cost

I. Initial Cost	Initial Cost	Annual Cost
(Equivalent of) 941-B Truck-type Loader 5.22* x 1040 hrs/yr.	$30,000	$ 5,430
3" Centrifugal Pump & Hose**	$ 1,000	$ 250
Maintenance Shed**	$ 1,000	$ 250
Engineering**	$ 5,000	$ 1,260
Initial Cost-$37,000		$ 7,190
II. Operating Expenses		
Equipment Operator $4.00/hr.-30 hrs./wk. (plus Soc.Sec., hospitalization, workman's comp., vacation and sick leave)		$ 7,800
Loader Operating Expenses 4.72* x 1040 hrs./yr		$ 4,910
Utilities-$80/month		$ 960
Insurance		$ 200
Misc. $50/month		$ 600
Property Lease		$ 1,200
Operating Cost		$ 15,676
TOTAL ANNUAL COST		$ 22,860

*See Table C-4
**Annual Cost Based on 5 yr. life at 8% interest.

Table C-4

HOURLY OWNING AND OPERATING COSTS

(From Caterpillar Performance Handbook-Fourth Edition)

Machine Designation . . . . 941-B Truck-type Loader

DEPRECIATION VALUE

1. Delivered Price (including attachments) . . . $ 30,000
2. (Optional) Less Resale Value or Trade-In. . . $ 0
3. Net Value for Depreciation. . . . . $ 30,000

OWNING COSTS

4. Depreciation: Net Depreciation Value (Item 3)
Depreciation Period in Hours

$$\frac{\text{Value } \$30{,}000}{\text{Hours } \$10{,}000}$$ ______ ______ ______ . . . $ 3.00

5. Interest, Insurance, Taxes:
Annual Rates: Int. 8%; Ins. 3%; Taxes 2%.
Estimated Annual Use in Hours 1040 hrs.

Factor x Delivered Price (Item 1)

$$\frac{.074 \times 30{,}000}{1000}$$ . . . . $ 2.22

6. TOTAL HOURLY OWNING COSTS . . . . $ 5.22

OPERATING COSTS

7. Fuel: 32¢ x 3.4 gal./hr. . . . . $ 1.09
8. Lubricants, Filters, Grease. . . . . $ .24

9. Repairs: $$\frac{\text{Factor x Del. Price}}{1000}$$

$$\frac{.09 \times 30{,}000}{1000}$$ . . . . $ 2.70

10. Special items:
Tips .42¢
Shank Protectors - .27¢ . . . . $ .69

11. TOTAL HOURLY OPERATING COSTS . . . . $ 4.72

12. TOTAL HOURLY OWNING AND
OPERATING COSTS . . . . $ 9.94

County Bulk Container System-- The bulk containers will serve two purposes. The first is to provide a more convenient place for the people to take their refuse. The second is to reduce the cost of operating the landfill by keeping the general public away. Calculating the number of containers required will be difficult and will only be a guess until the system is in operation.

To calculate the minimum number of containers necessary an estimate of the number of people who will use them will be needed. Table 3 indicates that 29.3% of the population of the county or 2,677 persons live on farms and these people can dispose of their waste on their own property. Previously it was estimated that 50% or 4,568 persons of the unincorporated area will subscribe to the mailbox collection system. This leaves 20.7% or 1,890 persons as the minimum number who will use the system.

Waste collected for this type of system has been estimated at one lb. per person per day. A minimum of twice per week collection of the containers is recommended. For design purposes, the containers are assumed to be ready for emptying when they are 80% full. The minimum required container storage space is calculated as follows: 1890 persons x 1 lb./person/day x 4 days ÷ 8 ÷ 200 lbs/cu.yd. = 47.25 cu.yds. This would indicate that a minimum of 12-four cubic yard or 8-six cubic yard containers would be required to accomodate the county.

Bulk Container Typical Annual Cost-- A typical annual cost has been developed for the bulk container system. The analysis assumes that 16-six cubic yard containers will be serviced. It is estimated that the 210 hours per year of crew time will be required to service the containers. The annual cost of the collection crew is about $10.00/hr. The typical annual budget for the county container system is as follows:

Typical Annual Cost County Container System

	Initial Cost	Annual Cost
I. Capital Investments		
16-six cu.yd. containers @$450.	$ 7,200	$ 2,800*
II. Service Charge		
210 hrs x $10/hr.		$ 2,100
TOTAL ANNUAL COST		$ 4,900

* Annual Cost computed on 3 yr. life at 8% interest.

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DENT COUNTY SOLID WASTE MANAGEMENT PLAN

Background

Purpose-- Few people that have ever been to the Salem city dump will deny that improvements in the present method of solid waste disposal are needed in Dent County. The placemats showing local attractions for one of the finest restaurants in town has the city dump listed as "Worth Seeing". The Salem dump, the worst rat-infested dump in the Region, can be located from almost any point in the county on a clear day by the column of black smoke rising from it.

The most serious problem caused by the dump, however, is groundwater pollution. Because it is located in a sink hole, all the surface water that leaches through the trash and garbage is being funneled into the groundwater supply. Tests are now being conducted by the Missouri Department of Natural Resources to determine if leachate from the dump has been contaminating the municipal water supply.

The purpose of this plan is to outline a method of properly closing the Salem dump, then establishing a sanitary, economical refuse collection and disposal system to serve the residents of Dent County. This plan is also intended to meet the planning requirements of the Missouri Solid Waste Management Act of 1972 for Dent County and can be adopted by the City of Salem to meet their planning requirements.

Background Data-- Population and housing data from the 1970 Census and MRPC surveys are listed in Table D-1 for Dent County and the cities in Dent County.

TABLE D-1: DENT COUNTY HOUSING DATA

	Population	Occupied Housing Units	Persons/ Housing Unit	Housing Units w/1 Person	Estimated No. of Businesses	Industries
Dent Co.	11,475	4,024	2.8	816	358	36
Unincorp.	6,885	2,237	3.1	316	103	18
Bunker (Dent Co.)	209	65	3.0	14	N.A.	N.A.
Salem	4,363	1,722	2.5	486	255	18

Development of the Plan-- Although the city dump is owned and operated by the City of Salem, it serves a large part of Dent County as well as Salem. The dump at Montauk State Park, which serves only the Park, is the only other dump operated in the county.

An inventory of the people using the dump indicated that people from all over the county, as well as people from as far away as Rolla, Licking, and Edgar Springs use the Salem dump. Since the Salem dump is a community dump, a community effort is needed to properly close it out and establish a new sanitary landfill.

Many attempts have been made to establish an agreement between Dent County and the City of Salem to jointly operate a landfill, but to-date none have been successful. The same attitude displayed in the present joint effort of the city and county toward establishing a city-county jail would result in the most efficient solution if applied to the solid waste problem.

The following plan has been developed by working with the County Court and City of Salem officials individually.

Solid Waste Management Recommendations

Management-- It is recommended that a not-for-profit corporation be formed to operate a county landfill with the Board members being County Court officials and City Council members. Since the population in the unincorporated area and the population of Salem are near equal, each governmental unit should have an equal vote. With proper financing, little, if any, capital outlay would be required by either governmental unit. The not-for-profit corporation would eventually also operate or supervise the operation of a city-county refuse collection system. For a current plan the city will continue operation of the municpal collection system and the county will regulate the operation of refuse collection in the rural areas. The Mayor of Salem will be responsible for the operation of the municipal collection system and the Presiding Judge will be responsible for regulating collection operations in the unincorporated areas. In the event the City and County cannot reach an agreement on operating a cooperative sanitary landfill, it is recommended the City of Salem operate a public landfill.

Storage-- On-site storage of solid waste will be regulated by city ordinances in the incorporated areas, and court orders in the unincorporated areas. The ordinances and court orders will be developed to meet the State requirements pertaining to container design and sanitary conditions previously mentioned on page 55 of this report.

Collection-- Each household, business, and industry in the City of Salem will be required to have refuse collection service. A minimum of once-per-week, curbside collection will be required. Refuse collection in Salem will be regulated by city ordinance and will meet the requirements also previously listed on page 59 as required by the state.

In the unincorporated areas of the County residents will be given three options. The first is to dispose of their own refuse on their own property as long as they meet the minimum requirements established by the Missouri Solid Waste Management Act. The second option will be for individuals to take their refuse to the landfill and pay a disposal charge. The final option will be for individuals to subscribe to one of the private mailbox collection services operating in the county.

Refuse collection in the unincorporated areas will be expanded on a phased basis. After the landfill has time to become established, service districts to provide a mailbox collection service within the county will be set-up. These service districts will be put out for bid and everyone in the County will be notified that the system is available and they must select one of the three options mentioned previously.

Operation of the collection system in the unincorporated areas will be regulated by county court order and will meet the requirements of the State mentioned on page 59.

Disposal-- Disposal of all solid waste will be in a sanitary landfill operated by either a city-county cooperative or by the City of Salem. A 113 acre site, which will last well beyond the 10 year period of this plan, has been purchased by the City of Salem and given preliminary approval by the Division of Health. Preparation of detailed engineering plans will be the next step required. Even though no excessive quantities of special problem waste were discovered in this study, the engineers plans will address methods of handling any special wastes encountered. Figure D-1 indicates the location of the proposed landfill and the percent of population living within a ten mile radius.

Closing of the present city dump should be done on a phased basis. The first step will be to stop all dumping, then the rodents must be eradicated. The site must then be graded and the refuse covered to where it drains into the natural water way, the expense of which should be included in the operating cost of the new landfill.

Financing-- Capital costs for development of the landfill can be financed through a Farmers Home Administration Loan, or private financing. The contractor in the County will be responsible for his own financing, and operating costs will be payed for by service charges.

POPULATION PROXIMITY TO PROPOSED LANDFILL

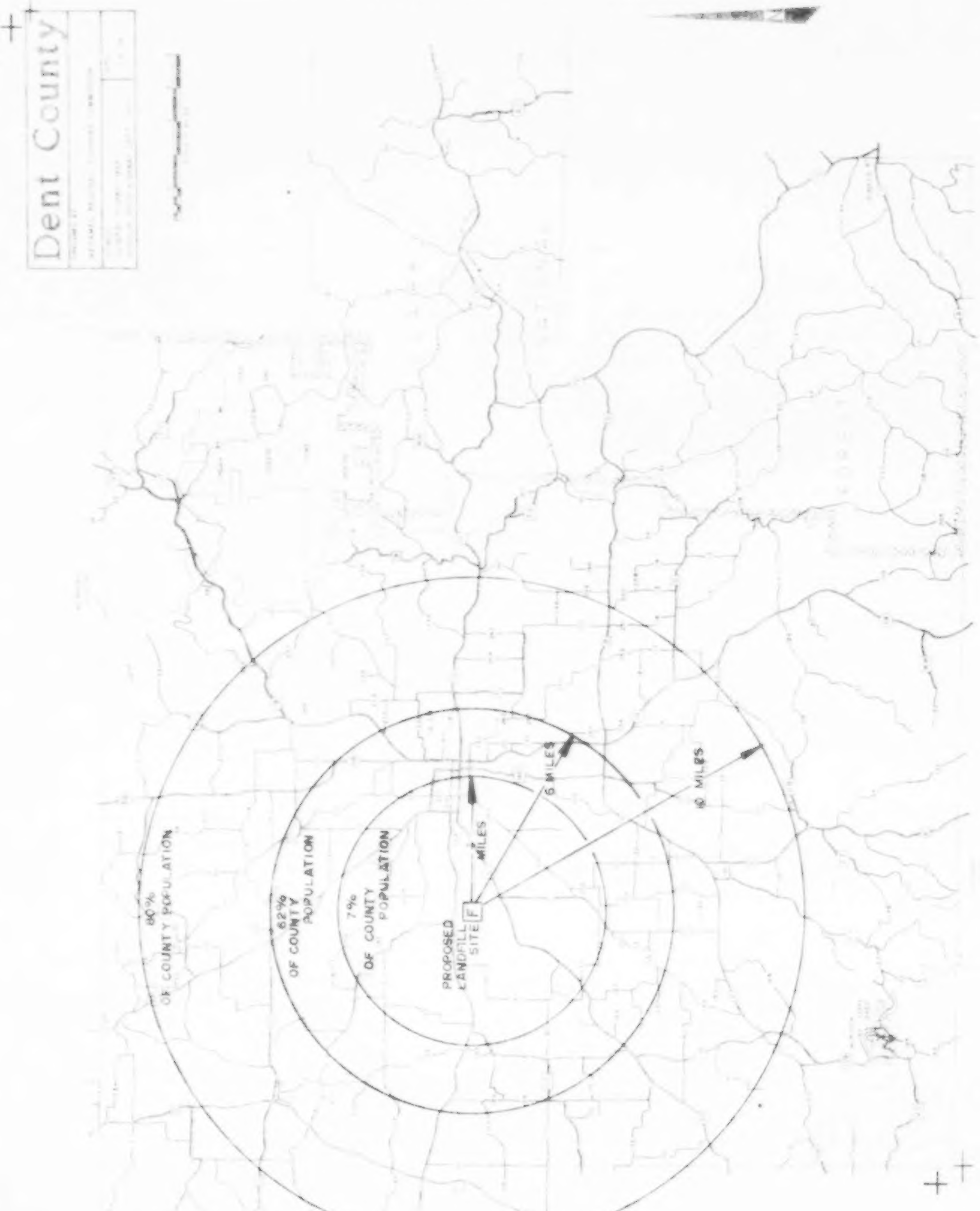

Dent County
80% OF COUNTY POPULATION
62% OF COUNTY POPULATION
7% OF COUNTY POPULATION
PROPOSED LANDFILL SITE
F
MILES
6 MILES
10 MILES

Fig. D-1

Implementation Schedule

July 1974-- Solid Waste Management Plan adopted.

January 1975-- Universal collection will have begun in Salem. The new landfill will begin operation. The County will have adopted a court order regulating collection operations in the County.

June 1975-- Closing of the old city dump will be complete.

June 1978-- County collection system will be in operation.

Solid Waste Management System Design

Salem Cost Comparisons-- Since the City of Salem will be changing to a uniform collection system and establishing a better method of waste disposal, it would be an excellent time to explore adopting another level of refuse service and possibly reduce the user fee. To aid the City Council with such a decision, several cost comparisons of alternate collection systems were made. The first comparison assumed expansion of the existing collection system which is a modified backyard collection service with a three-man crew. The second comparison was for the same level of service as the first only with a two-man crew. The third comparison was for curbside collection of disposable containers, only the excess time of the crew would be spent on a rural collection route.

Three alternatives were compared for the refuse disposal system. The first was a landfill operated with a piece of equipment equivalent to a Caterpillar 983 Track-Type loader. The second alternative compared a landfill operated with a piece of equipment equivalent to a John Deere 646 landfill compactor. The final disposal alternative assumed hauling the refuse to a neighboring landfill. A typical annual cost was also prepared on the management and billing cost which should be allocated to the sanitation department.

Cost Summary for Salem-- A cost summary of the solid waste management alternatives for the City of Salem is indicated below. The cost shown includes a 20% contingency.

	Bk.Yd. Coll. 3-Man Crew	Bk.Yd Coll. 2-Man Crew	Curb.Coll.	Curb.Coll. w/ Rural Route
(A) Landfill w/ Cat.983 equiv.	$ 4.15	$ 3.59	$ 3.30	$ 2.75
(B) Landfill w/ J.D. 646 equiv.	$ 3.66	$ 3.10	$ 2.81.	$ 2.26
(C) Hauling to Neighboring Landfill	--	--	$ 2.35	--

COLLECTION SYSTEM GENERAL DESIGN CRITERIA

A. Average times per service - Developed from studying the Salem and similar collection systems in neighboring towns. Additional information is available from the Regional Planning Commission.

B. Generators
   1. 1761 households requiring service
   2. Commercial & Industrial
      a. 244 Businesses, 6 Industries
      b. 63 Businesses using same service as households
      c. 56 - one cubic yard containers
      d. 31 - two cubic yard containers

C. Waste Generation
   1. Residential Generation Rate - 2 lbs. per person per day
   2. Combined Commercial and Residential Generation Rate - 3 lbs. per person per day
   3. Industrial Generation - 13,243 lbs. per wk.

D. Collection Times
   1. Trips to the Salem Landfill will average 30 minutes
   2. Each crew takes two - 15 minute breaks per day
   3. Each crew spends one hour each day on truck and container maintenance

City of Salem Refuse Collection System

COLLECTION PLAN 1

I. To provide backyard carry out service using 3-men crews. This is the system that Salem is now using. Commercial and industrial services are either collected in cans or containers depending on volume. All collections are made twice per week.

A. Advantages of the three-man crew
   1. Will increase the number of services made per day

B. Disadvantages
   1. Less efficient

II. System Design

A. Design criteria
   1. Average time per household service - .58 minutes
   2. Average time per container service - 1.5 minutes

B. Collection time estimates
   1. Residential collection
      a. Collection Time Required - 1761 x .58 x 2 = 2053 min. -- -- = 34 hours 13 min. per week
      b. Disposal time

(1) 1,761 households x 2.53 persons/household x 2#/person/day x 7 days = 68,612 lbs. of trash/wk.
(2) 62,375 lbs./600# = 115 compacted cu.yd./wk.
(3) using the existing 9 cu.yd. truck and assuming 70% full loads - 15 loads per wk. will be needed
(4) 15 trips x 30 min./trip = 450 min. = 7.5 hours per week

c. Residential Collection Time Allocations
(1) Collection -- 34 hours 13 min. per week
(2) Disposal -- 7 hours 30 min. per week
(3) Breaks -- 3 hours 48 min. per week
(4) Maintenance -- 7 hours 36 min. per week
Total weekly time spent on Residential Collection -- 53 hr.7 min.

2. Commercial and Industrial Collection
a. Estimated Collection Time
(1) Commercial cans - 63 cans x .58 min. x 2 serv/wk. = 73 min. = 1 hr. 13 minutes
(2) Containers - 87 containers x 1.5 min. x 2 serv/wk. = 261 min. = 4 hrs. and 21 minutes
(3) Special Pick-ups - 5 hrs./wk.

b. Disposal Time
(1) Total weekly industrial and commercial generation - 44,430#/wk.
(2) 44,430#/600#/cu.yd. = 74 compacted cu/yds./wk.
(3) Using a 13 cu.yd. truck and assuming 70% full loads -
(4) 8 trips x 30 min. = 4 hrs. per wk.

c. Commercial Collection Time Allocations
Collection -- 10 hrs 34 min per week
Disposal -- 4 hrs per week
Breaks -- 1 hr 12 min per week
Maintenance -- 2 hrs 24 min per week
Total weekly time spent on commercial collection -- 18 hours 10 minutes

3. Total weekly collection time required = 71 hrs. 17 min.

C. Percentage breakdown of time allocations

1. Residential collection	75%
2. Commercial collection	25%
a. Can service	12%
b. Container	41%
c. Special pickups	47%

III. Annual Cost

A. Equipment investments	Initial Cost	Annual Cost
1. 13 cu.yd. compactor truck*	$ 12,500	$ 3,131
2. Compactor truck reserve**	$ 25,000	$ 4,525
3. Cleaning & maintenance equipment*	$ 2,500	$ 627
	Subtotal---	$ 8,283

4. Containers	Initial Cost	Annual Cost
a. 61 one cu.yd. - @ $110 ea.***	$ 6,710	$ 3,763
b. 36 two cu.yd. - @ $160 ea.***	$ 5,760	$ 3,230
	Subtotal----	$ 6,993

B. Personnel
  1. 2 drivers - $2.20 per hour plus social security plus insurance = $10,320
  2. 4 collectors - $2.20 per hour plus social security plus insurance = $20,640

C. Operating Expenses

1. Gasoline - 3744 hours @ 2.2 gallons per hour @ 60¢per gallon	=	$ 4,942
2. Oil - 3744 hours @ .04 quart per hour @ 35¢ per quart	=	$ 53
3. Parts and repairs a. Repair labor - 50¢ per operating hour b. Repair parts - $1.00 per operating hour $1.50 per hour x 3744 operating hours per year	=	$ 5,616
4. Utilities - $50 per month	=	$ 600
5. Phone - $20 per month	=	$ 240
6. Maintenance - $50 per month	=	$ 600
7. Insurance	=	$ 400
		$12,451

D. Regular Annual Operating Expenses

1. Equipment (less containers)	$ 8,283
2. Personnel	$ 30,960
3. Operating expenses	$ 12,451
	$ 51,694

IV. Collection Cost

A. Cost Allocations
  1. Cost allocated to residential accounts---- .75 x 51,694 = $38,770
  2. Cost allocated to commercial accounts ---- .25 x 51,694 = $12,924

B. Residential Collection cost - $38,770 ÷ 12 months ÷ 1761 = $1.84 per user per month

C. Commercial and Industrial Collection Cost
  1. Monthly can service- .12 x 12,924 ÷ 12 ÷ 63 = $2.05 per serv.
  2. Container Service
    a. Monthly collection cost - .41 x 12,924 ÷ 12 ÷ 87 = $5.08
    b. Monthly container rental
      (1) one cubic yard container-3,763 ÷ 12 ÷ 56 = $5.60
      (2) two cubic yard container-3,230 ÷ 12 ÷ 31 = $ 8.60
    c. Monthly container cost - Rental and service
      (1) one cubic yard = $10.68
      (2) two cubic yard = $13.68
  3. Cost for special pickup -- .47 x $12,924 ÷ 12 months ÷ 1302 min. = $ .38 per minute

City of Salem Refuse Collection System

COLLECTION PLAN 2

I. To provide backyard carry-out service, the same as the city now has only using two-man crews. Commercial or industrial services are either collected in cans or containers, depending on the volume of trash. All collections are made twice per week.

  A. Advantages of the backyard carry-out service
    1. Requires less user participation
    2. No cans along street

  B. Disadvantages
    1. Collector must trespass to get trash
    2. Usually more expensive
    3. Higher injury rate

II. System Design
  A. Design Criteria
    1. Average time per household service---- .68 minutes per service
    2. Average time per container service---- 1.5 minutes

  B. Collection Time Estimates
    1. Residential Collection
      a. Collection time required - 1761 households x .68 minutes per service x 2 collections per week = 2394 minutes or 40 hours per week
      b. Disposal time - same as in Plan 1 - 7 hours 30 minutes.
      c. Residential collection time allocation
        (1) collection - 40 hours per week
        (2) disposal - 7 hours 30 minutes per week
        (3) breaks - 3 hours 54 minutes per week
        (4) maintenance- 7 hours 48 minutes per week
        Total weekly time spent on residential collection = 59 hours 12 minutes
    2. Commercial and Industrial Collection
      a. Estimated Collection Time
        (1) commercial cans - 63 x .68 min. per service x 2 services per wk. = 86 min. = 1 hr. 26 min.
        (2) containers - 87 containers x 1.5 min./container x 2 services per wk. = 261 min. = 4 hrs. 21 min. per wk.
        (3) special pick-ups - 5 hrs. per wk.
      b. Disposal time - same as in Plan 1 - 4 hrs.
      c. Commercial Collection Time Allocations:
        Collection - 10 hrs 47 min per week
        Disposal - 4 hrs per week
        Breaks - 1 hr. 6 min per week
        Maintenance - 2 hrs 12 min per week
      Total weekly time spent on commercial collection - 18 hrs and 5 min.
    3. Total Weekly collection time required = 77 hrs & 17 min.

C. Percentage Breakdown of Time Allocation
  1. Residential Collection - 77%
  2. Commercial Collection - 23%
    a. Commercial Can Pick-up - 13%
    b. Container Collection - 40%
    c. Special pick-ups - 47%

III. Annual Cost

A. Equipment Investments same as Plan 1 *, **, ***

B. Personnel
  1. 2-drivers @$2.50 per hr plus social security and insurance = $ 10,320
  2. 2-collectors @$2.20 per hr plus social security and insurance = $ 10,320

$ 20,640

C. Operating Expenses (same as Plan 1)

D. Operation Expenses:

Equipment cost ------	$ 8,283
Personnel ------	$ 20,640
Operating Expenses --	$ 12,451
	$ 41,374

IV. Collection Costs

A. Cost allocations
  1. Cost allocated to residential accounts
     .77 x $41,374 = $ 31,858
  2. Cost allocated to commercial accounts
     .23 x $41.374 = $ 9,516

B. Residential Collection Cost ÷ monthly cost for service --
   $ 31,858 ÷ 12 ÷ 1761 = $ 1.51 per service

C. Commercial and Industrial Collection Cost
  1. Monthly can service cost - .13 x 9,516 ÷ 12 ÷ 63
     = $ 1.63 per service
  2. Container Service-
    a. Monthly Cost for Service = .40 x 9516 ÷ 12 ÷ 87 = $3.65 per service
    b. Container Rental (per month)
      (1) one cubic yard - $5.60
      (2) two cubic yard - $8.69
    c. Monthly Container Cost - Rental and Service
      (1) one cubic yard - $9.25
      (2) two cubic yard - $12.34
  3. Cost for Special Pick-up Service --
     .47 x 9516 ÷ 12 ÷ 1302 = 29¢ per minute

City of Salem Refuse Collection System

COLLECTION PLAN 3

I. To provide to the customers plastic bags which are collected at the curbside. The crew will consist of two men, a driver and a collector. Commercial and Industrial services are either plastic bags or one of two cubic yard containers. All collections are made twice per week.

- A. Advantages
  - 1. Usually most economical
  - 2. Sanitary for collection
  - 3. Less noise during collection
  - 4. No unsightly cans
  - 5. Less blowing papers at landfill
- B. Disadvantages
  - 1. Requires more user participation
  - 2. Difficulty distributing bags
  - 3. Animals sometimes tear bags

II. System Design

- A. Design Criteria
  - 1. Average time per service for bags - .41 minute
  - 2. Average time per container service - 1.5 minutes
- B. Collection Time Estimates
  - 1. Residential collection
    - a. Collection time required - 1,761 households per week x .41 minutes per service x 2 services/wk = 24 hrs/4 min/wk.
    - b. Disposal time - Same as Plan 1 = 7.5 hours
    - c. Residential collection time allocations
      - (1) collection - 24 hrs per wk.
      - (2) disposal - 7 hrs 30 min per wk.
      - (3) breaks - 2 hrs 30 min per wk.
      - (4) maintenance- 5 hrs per wk.
      - Total weekly time spent on residential collection-39 hrs/wk.
  - 2. Commercial and Industrial Collection
    - a. Estimated collection time
      - (1) collection time bag services
        63 x .41 x 2 = 52 min/per/wk.
      - (2) collection time containers
        1.5 min. x 87 x 2 - 261 min. = 4 hrs/21 min. /wk.
      - (3) collection time special pickups - 5 hours per week
      - (4) total weekly commercial collection time = 10 hrs/13 min.
    - b. Disposal Time
      - (1) total weekly industrial and commercial generation - 44,430#/wk.
      - (2) 44,430#/600#/cu.yd. = 74 compacted cu.yds./wk.
      - (3) using a 13 cu.yd. truck and assuming 70% full loads -
      - (4) 8 trips x 30 min. = 4 hrs/wk.

c. Commercial collection time allocations

Collection - 10 hrs. 13 min. per wk.
Disposal - 4 hrs. per wk.
Breaks - 1 hr. 15 min. per wk.
Maintenance - 2 hrs. 30 min. per wk.

Total weekly time spent on commercial collection = approximately 18 hours per week

3. Total weekly collection time required - 57 hours.
71% of two crews' time is spent on city route collection.

C. Percentage Breakdown of Allocation

1. Residential collection - 68%
2. Commercial collection - 32%
   a. Bag commercial collection - 9%
   b. Container collection - 42%
   c. Special pickups - 49%

III. Annual Cost

A. Equipment investments (Same as Plan 1) *, **, ***

B. Personnel

1. 2 drivers - $2.20 per hour plus social security and insurance	$ 10,320
2. 2 collectors - $2.20 per hour plus social security and insurance	$ 10,320
	$ 20,640

C. Operating expenses

1. Gasoline - 3744 hours @ 2.2 gallons per hour @ 60¢ per gallon =	$ 4,942
2. Oil - 3744 hours @.04 quart per hour @35¢ per quart	$ 53
3. Parts and repairs	
a. Repair labor - 50¢ per operating hour	
b. Repair parts - $1.00 per operating hour	
$1.50 per hour x 3744 operating hours per year =	$ 5,616
4. Utilities - $50 per month	$ 600
5. Phone - $20 per month =	$ 240
6. Maintenance - $50 per month =	$ 600
7. Insurance =	$ 400
Subtotal	$ 12,451
8. Plastic Bags	
a. Residential - 8 bags per customer per month x 12 x 1761 @6¢ per bag =	$ 10,144
b. Commercial - 16 bags per customer per month x 12 x 63 @ 6¢ per bag =	$ 726
Subtotal	$ 10,870

D. Regular Annual Operating Expenses

1. Equipment (less containers) * & ** = $ 8,283
2. Personnel = $ 20,640
3. Operating expenses (less bags) = $ 12,951

TOTAL $ 41,374

IV. Collection Cost

A. Cost Allocations

1. Cost allocated to residential accounts
.68 x $41,374 = $ 28,134
2. Cost allocated to commercial accounts
.32 x $41,374 = $ 13,240

B. Residential Collection Cost

1. Monthly cost for service
$28,134 ÷ 12 ÷ 1761 = $1.24 $ 1.33
2. Monthly cost for plastic bags - 8 bags
per month x 6¢ per bag = 48¢ per service $ .48
3. Monthly cost per service for collection $ 1.81

C. Commercial and Industrial Collection Cost

1. Bag Service
a. Cost for bag collection
.09 x $13,240/12 months/63 services = $ 1.58
b. Cost for plastic bags - 16 bags per
month x 6 ¢ per bag = $ .96
c. Monthly cost per service for collection $ 2.54
2. Cost for container service
a. Monthly collection cost - .42 x $13,240
÷ 12 months ÷ 87 = $ 5.33
b. Container rental (per month)
(1) one cubic yard container - $3,763
÷ 12 ÷ 56 = $ 5.60
(2) two cubic yard container - $3,230
÷ 12 ÷ 31 = $ 8.69
c. Monthly container cost - rental and service
(1) one cubic yard container = $ 10.93
(2) two cubic yard container = $ 14.02
3. Cost for special pick-up service -
.49 x $13,240 ÷ 12 mo. ÷ 1302 min/mo. = $ .42 per/min.

* Based on five year debt retirement at 8% interest
** Based on five year investment at 5% interest
*** Based on 2 year debt retirement at 8% interest plus container maint.

City of Salem Refuse Collection System

COLLECTION PLAN 4

I. To provide the same service as in Plan 3 only the time the two crews are not spending on a city collection route will be allocated to a rural collection route. With the Hospital, Industries and Subdivision on the outskirts of the City, there should be no trouble occupying the remaining time.

A. Advantages

1. Allows most efficient use of the sanitation departments time.
2. Allows for a profit to be made which can be used to ease the burden of rising cost to the city user.
3. Give greater flexibility to the growing city collection system. As the city collection system grows the rural collection system can be reduced.

B. Disadvantages

1. More demanding on the City's Administration
2. System must be run as a business

II. System Design

A. Design Criteria - Same as Plan 3

B. Collection Time Estimates - Same as Plan 3

C. Percentage breakdown of time allocations

1. City Collection Route - 71%
    a. Residential collection - 68%
    b. Commercial collection - 32%
        (1) Bag commercial collection - 9%
        (2) Container collection - 42%
        (3) Special pickups - 49%
2. Rural Collection Route - 29%

III. Annual Cost - Same as in Collection Plan 3 (with the exception of an increase in the number of containers and bags required)

IV. Collection Cost

A. Cost Allocation

1. Cost allocated to city accounts - .71 x $41,374 = $ 29,376
    a. Cost to residential accounts - .68 x $29,376 = $ 19,976
    b. Cost to commercial accounts - .32 x $41,374 = $ 9,400
2. Cost allocated to rural accounts - .29 x $41,374 = $ 11,999

B. Residential Collection Cost (City)

1. Monthly cost for service
   $ 19,976 ÷ 12 ÷ 1761 = $ .95/service
2. Monthly cost for plastic bags - 8 bags per month
   @ 6¢ per bag = $.48 / service
3. Monthly cost per service for collection = $ 1.43 / service

C. Commercial and Industrial Collection Cost (City)

1. Bag Service
   a. Monthly cost for bag collection
      .09 x $9400 ÷ 12 months ÷ 63 services = $ 1.12
   b. Monthly cost for bags - 16 bags per month
      x .06¢ per bag = $ .96
   c. Monthly cost per service for collection = $ 2.08
2. Cost for Container Service
   a. Monthly collection cost -
      .42 x $9,400 ÷ 12 months ÷ 87 = $ 3.78
   b. Monthly container rental
      (1) one cubic yard container = $ 5.60
      (2) two cubic yard container = $ 8.69
   c. Monthly container cost-rental & service
      (1) one cubic yard container = $ 9.38
      (2) two cubic yard container = $12.47
3. Cost for special pick-up service -
   .49 x $9,400 ÷ 12 mo. ÷ 1302 min/mo. = $ .30 per min.

D. Rural Collection Cost

At the request of the city council a rate study for a rural collection route will be made.

CITY OF SALEM

PLAN A

SANITARY LANDFILL TYPICAL ANNUAL COST

I. Operating a sanitary landfill with earth-moving equipment equivalent to a 983 track-type loader equipped for sanitary landfill operation. The cost of the all-weather road, fencing and landscaping is not included. To estimate these items a more detailed landfill design will be needed. So the actual cost of operating the landfill will be more than indicated here.

II. Capital Expenses

	Capital Cost	Annual Cost
Land - 113 ac. @ $200/ac.	$ 22,600	
8% int. on 20 yr. life		$ 2,302
983 Track-Type Loader	$ 95,000	
$10.43 * x 1820 hrs/yr.		$ 18,983

* from Table D-2

Plan A, Annual Cost, Cont.

	Capital Cost	Annual Cost
2½ Sump Pump	$ 500	$ 125
Metal Building 30' x 40' @$4/sq.ft.	$ 4,800	
8% int. on 20 yr. life		$ 489
Sewage Lagoon	$ 1,000	
8% int. on 10 yr. life		$ 150
Well	$ 2,000	
8% int. on 10 yr. life		$ 298
Engineering.	$ 5,000	
8% int. on 10 yr. life		$ 1,253
Road		
Fencing		
Capital Expenses (less road, fencing)	$131,400	$ 23,600

III. Operating Expenses

Equipment Operator - $3.00/hr.+soc.sec. and ins.	$ 7,052
Landfill Manager - $2.20/hr.+ soc.sec. and ins.	$ 5,160
Loader Operating Expenses- 10.90* / hr x 1820 hrs / yr.	$ 19,838
Container Rental - 4 two-yd containers @$8.60/mo.	$ 413
Utilities - $50 / month.	$ 600
Phone - $20 / month.	$ 240
Misc. - $50 / month.	$ 600
Operating Expenses	$ 33,903

IV. Total Annual Budget (less road & fencing) . . . . $ 57,503

V. Disposal User Fees

A. Annual Solid Waste Landfilled

Residential -----------------	1,622 tons	-----43%
Industrial & Commercial -----	1,156 tons	-----31%
Rural Users (estimate) ------	1,000 tons	-----26%
TOTAL	3,778 tons	100%

B. Cost Allocations

Residential -- .43 x 57,503 = $24,726
Commercial - .31 x 57,503 = $17,826
Rural Disposal Fee -- .26 x 57,503 = $14,951

C. Monthly Residential Disposal Cost

$24,726 / 12 months / 1761 = $ 1.17 / month

TABLE D-2

HOURLY OWNING AND OPERATING COSTS
(From Caterpillar Performance Handbook, Fourth Edition)

Machine Designation . . . . 983-Track-Type Loader

DEPRECIATION VALUE

1. Delivered Price (including attachments). . . . . . $ 95,000
2. (Optional) Less Resale Value or Trade-In . . . . . $ 20,000
3. Net Value for Depreciation. . . . . $ 75,000

OWNING COSTS

4. Depreciation: Net Depreciation Value (Item 3) / Depreciation Period in Hours

   $\frac{\text{Value } \$75{,}000}{\text{Hours } 12{,}000}$ . . . . $ 6.25

5. Interest, Insurance, Taxes:
   Annual Rates: Int. 8%, Ins. 3%, Taxes ____%
   Estimated Annual Use in Hours 1,820 - 7 hrs/day - 5 days/wk.

   Factor x Delivered Price (Item 1)

   $\frac{.044 \times \$95{,}000}{1000}$ . . . . $ 4.18/hr.

6. TOTAL HOURLY OWNING COSTS . . . . $ 10.43

OPERATING COSTS

Unit Price x Consumption

7. Fuel: $ .40 x 11.3 . . . . $ 4.52/hr.
8. Lubricants, Filters, Grease . . . . $ .30/hr.
9. Repairs: $\frac{\text{Factor x Del. Price}}{1000}$

   $\frac{.09 \times 85{,}000}{1000}$ . . . . $ 7.65/hr.

10. Special items:
    Tips (3 @$21) ÷ 150 hrs = $.42 . . . . $ .69/hr.
    Shank Protectors = $.27

11. TOTAL HOURLY OPERATING COSTS . . . . $ 13.16

12. Operator's Hourly Wage . . . . ____________

13. TOTAL HOURLY OWNING AND OPERATING COSTS. . . . . . . $ 23.59

CITY OF SALEM

Plan B

SANITARY LANDFILL TYPICAL ANNUAL BUDGET

I. Operating a sanitary landfill with earthmoving equipment equivalent to a 955-L track-type loader equipped for sanitary landfill operation. Again, as in Plan A, the cost of the road, fencing, and landscaping has not been included.

II. Capital Expenses

	Capital Cost	Annual Cost
Land - 113 acres @$200/ac	$ 22,600	
8% int. on 20 yr. life		$ 2,302
955-L track-type loader	$ 45,000	
$4.90* x 1820 hrs/yr		$ 8,918
2½" Sump Pump	$ 500	
8% int. on 5 yr. life		$ 125
Metal Building 30' x 40' @$4/sq/ft	$ 4,800	
8% int.-20 yr. life		$ 489
Sewage Lagoon	$ 1,000	
8% int. - 10 yr. life		$ 150
Well	$ 2,000	
8% int. - 10 yr. life		$ 298
Engineering	$ 5,000	
8% int. - 5 yrs.		$ 1,253
Road		
Fencing		
Capital Expenses (less road, fencing)	$ 80,900	$ 13,535

III. Operating Expenses

Equipment Operator - $3.00/hr + soc.sec. & ins.	$ 7,052
Landfill Manager - $2.20/hr + soc.sec. & ins.	$ 5,160
Loader Operating Expenses-$5.27* x 1820/hrs	$ 9,592
Container Rental - 4 two cu.yd. containers @ $8.60/month	$ 413
Utilities - $50/month	$ 600
Phone - $20/month	$ 240
Misc. - $50/month	$ 600
OPERATING EXPENSES	$ 23,657

IV. TOTAL ANNUAL BUDGET (less Road & Fencing) ------------ $ 37,192

V. Disposal User Fees

A. Annual Solid Waste Landfilled

Residential	1622 tons	43%
Industrial & Commercial	1156 tons	31%
Rural Users (estimate)	1000 tons	26%
TOTAL	3778 tons	100%

*From Table D-3

B. Cost Allocation
Residential .43 x $37,192 = $ 15,992
Industrial & Commercial .31 x 37,192 = $ 11,530
Rural Users .26 x 37,192 = $9,670

C. Monthly Residential Disposal Cost
$15,992 / 12 months / 1761 = $ 0.76 / month

TABLE D-3

HOURLY OWNING AND OPERATING COSTS
(From Caterpillar Performance Handbook, Fourth Edition)

Machine Designation	955 L Track-type Loader
DEPRECIATION VALUE	
1. Delivered Price (including attachments)	$ 45,000
2. (Optional) Less Resale Value or Trade-In	$ 10,000
3. Net Value for Depreciation	$ 35,000
OWNING COSTS	
4. Depreciation: $\frac{\text{Net Depreciation Value (Item 3)}}{\text{Depreciation Period in Hours}}$	
$\frac{\text{Value}}{\text{Hours}}$ $\frac{35,000}{12,000}$	$ 2.92
5. Interest, Insurance, Taxes: Annual Rates: Int. 8%, Ins. 3%, Taxes __% Estimated Annual Use in Hours - 1820 - 7 hrs/day x 260 hrs/yr. Factor x Delivered Price (Item 1)	
$\frac{.044 \times \$45,000}{1000}$	$ 1.98
6. TOTAL HOURLY OWNING COSTS	$ 4.90
OPERATING COSTS Unit Price x Consumption	
7. Fuel: $ .40 x 5.7	$ 2.28
8. Lubricants, Filters, Grease	$ 0.18
9. Repairs: Factor x Del. Price	
$\frac{.09 \times \$33,000}{1000}$	$ 2.97
10. Special Items: Tips . . . $0.42 Shank Protectors $0.27	$ .69
11. TOTAL HOURLY OPERATING COSTS	$ 6.12
12. Operator's Hourly Wage	
13. TOTAL HOURLY OWNING AND OPERATING COSTS	$ 11.02

CITY OF SALEM

DISPOSAL PLAN C

I. To haul the cities refuse to a neighboring landfill with a larger population base, different operating conditions and a lower disposal cost. Since it will take considerably longer on the collection time to transfer the trash to another landfill only Plan 3 could be used with this disposal plan.

II. Transfer Time Available

A. Weekly time that could be used for transfer (from collection plan 3)

1. Surplus weekly time -- 23 hours
2. Weekly time allocated to disposal -- 11 hrs. 30 min.
3. Total available disposal time -- 34 hrs. 30 min.

B. Estimated Time Per Trip Available

1. 23 trips to disposal site per week
2. 34.5 hrs/23 trips = 1.5 hrs per trip

III. Disposal Cost

A. Annual refuse generation (from collection plan 1) = 2878 tons

B. Estimated Charge at Neighboring Landfill = $ 5.00 / ton

C. Annual Disposal Cost - 2878 x $5 = $ 14,390

D. Monthly Residential Disposal Cost
1622 tons x $5 / 12 / 1761 = 39¢ per month

City of Salem Refuse Collection System

MANAGEMENT & BILLING

Management costs always seem high at first, but without good management even the best designed system can soon be costing the people of Salem far more than it should. The major cost in a refuse handling system is people and people need supervision. Also the budget must be constantly looked at to see if any portion is costing more than it should. If any portion is costing too much the administrator must find out why and correct it. The dollars that Salem invests in management can be the best spent money the city has.

Salaries in the first years budget are estimates and can be easily adjusted. Other items the council feels need to be added or dropped can also be changed. Again this budget is only a starting point in the design.

I. Typical Annual Cost

A. Administrative Cost

City Administrator (Mayor) - $10,000 Annual plus
25% personnel burden - 10% of time = --$ 1,250

Superintendent - $8,000 annual plus 25% personnel
burden --33% of time = --$ 3,333

Subtotal----$ 4,583

B. Billing Cost

Billing Clerk - $4,000 annual plus 25% personnel
burden - 25% of time = --$ 1,250
Mailing - 2,011 mailings x 12 months
x $ .10 x .25 = --$ 604
Building Rent and Maintenance-$200 x 12 months
x .25 = $ 600

$ 2,454

C. Personnel Support (Street Department)

1. Average Annual Off-time per year

Sick Leave	-	8 days	=	64 hrs.
Vacation	-	10 days	=	80 hrs.
Holidays	-	7 days	=	56 hrs.
		TOTAL		200 hrs./man/yr.

2. Annual Cost Allocated to Sanitation Department for Personnel Support
   200 hrs. x 4 men x $2.75/hr. = $ 2,200

3. Annual cost allocated to landfill for personnel support
   a. 200 hrs x 3.75 = $ 750
   b. 200 hrs x 2.75 = $ 550

D. Totals

Administrative & Personnel Support = $8,083
Billing = 2,454

Cost Allocations

1. Monthly Billing Cost
   $2,454 ÷ 12 months ÷ 2,011 billings = $ .11 per billing

2. Monthly Administrative & Personnel Support Cost
   (From percentage breakdown of time allocations)
   Monthly cost - $8,083 ÷ 12 = $ 674

The user cost for administrative and personnel support services allocated from the percentage-time breakdowns are indicated below:

Type of Service	Plan 1	Plan 2	Plan 3	Plan 4
Residential*	.29	.33	.26	.18
Regular* Commercial	.32	.32	.31	.23
One cu.yd.* Container	.80	.72	1.05	.74
Two cu.yd.* Container	.80	.72	1.05	.74
Special** Pick-up	.06	.06	.09	.06

Dent County Mailbox Collection System-- To provide the County Court with an idea of what the monthly user fee for a mailbox collection system might be a routing analysis was made on a county routing system. Since the proposed landfill is in the center of the county both geographically and population-wise, a good routing method could readily be developed. It was found that 64% of the population in the unincorporated area live within a 10 mile radius of the proposed landfill. Also aiding in the developing of routes is the fact that the highway network radiates from the center of the county.

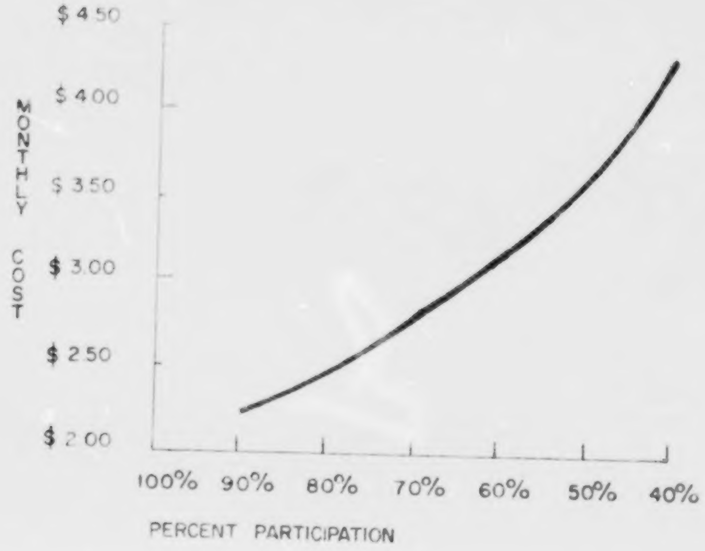
Mailbox Collection System Cost Summary-- How many people subscribe to the service will determine the amount the customer pays. It appears that two crews will be necessary if a majority of the roads are to be driven on a route and service made available to almost everyone in the county. Table D-4 indicates the projected user cost with varying percentages of participation. Figure D-2 was developed to show the importance of having a high rate of subscribers in a mailbox system. The figure shows how the projected user cost decreases as the percentage of subscribers increases.

TABLE D-4

Monthly Projected User Cost Summary				
Percent Participation	Collection	Disposal	Management & Billing	Total
90%	$ 1.24	.64	.35	$ 2.23
80%	$ 1.40	.67	.39	$ 2.46
70%	$ 1.60	.71	.44	$ 2.75
50%	$ 2.23	.79	.60	$ 3.62
40%	$ 2.79	.83	.75	$ 4.37

Figure D-2

CHART SHOWING DECREASE IN COST AS PERCENTAGE OF PARTICIPATION INCREASES



Mailbox Collection System Routing Analysis-- Figure D-3 shows the ten balanced route areas the county was divided into. All ten could be served by two crews. Population densities, roadmiles, ability to establish a closed loop route and distance from the landfill were the factors considered in developing the route areas. No area has over 300 households, which is assumed to be a full days work for a rural collection crew. An attempt was made to develop a routing scheme that, with a lower percent participation, could serve the entire county with one crew. Due to the number of road miles that had to be traveled, however, this scheme could not be established.

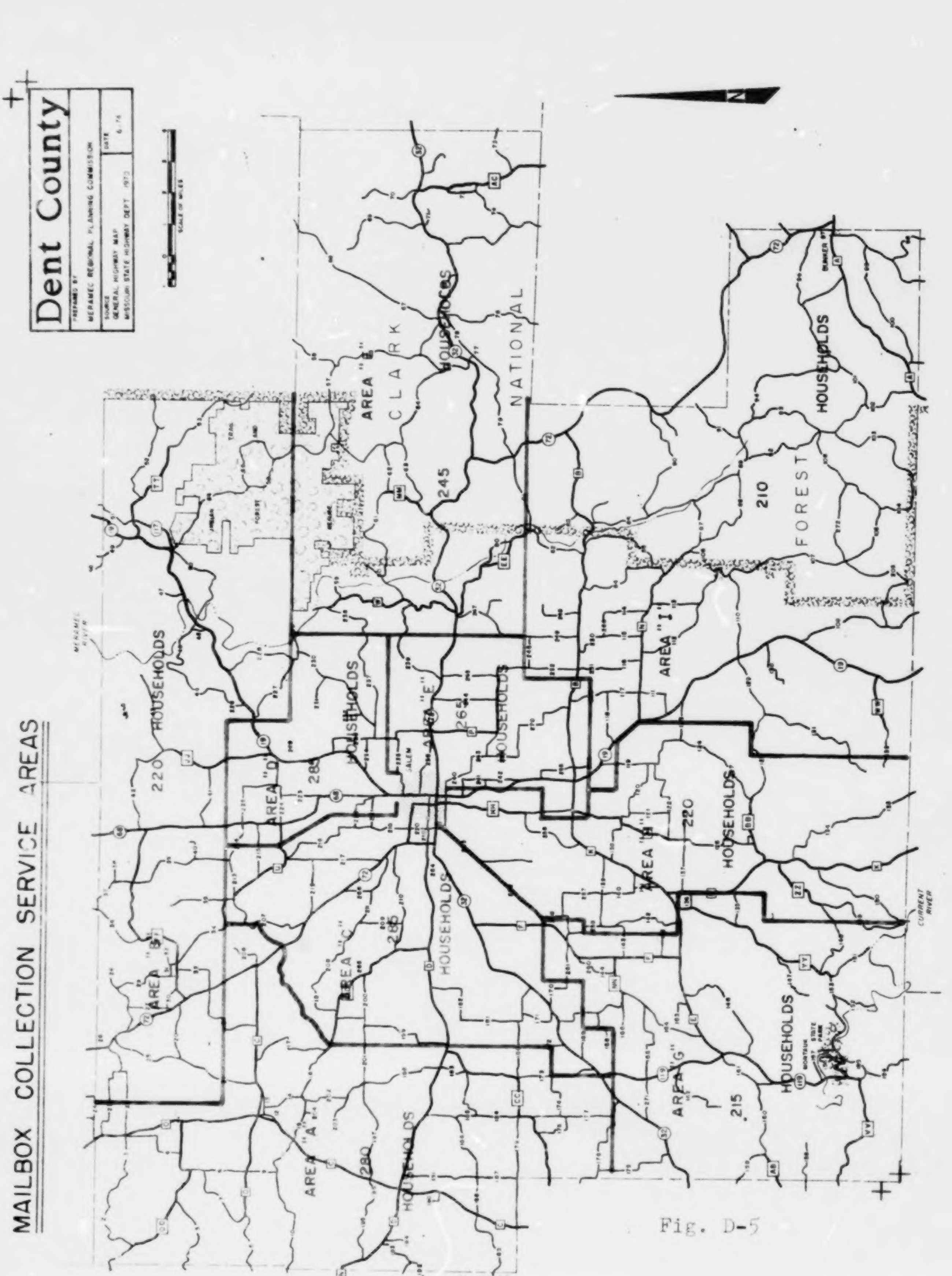
It would be possible to offer refuse collection service only in the more populated areas, such as areas A, C, D, E, and F. By only using one crew, the cost would be lower, however, if the areas to be serviced were established by the County Court, political problems could arise for undoubtedly the people in the areas without service would feel discriminated against.

Mailbox Collection System Annual and User Cost-- Typical annual costs and a project user cost with different percentages of participation have been developed below.

Typical Annual Collection Cost

	Initial Cost	Annual Cost
I. Equipment		
Two - 10 cu.yd. Compactor Trucks	$ 24,000	$ 6,011*
II. Personnel		
Two Drivers-Collectors @$3.15/hr. plus fringe benefits		$14,810
III. Operating Expenses		
Gasoline - 3640 hrs x 2.3 gal/hr @ 60¢/gal.		$ 5,023
Oil - 3640 @ .04 qt./hr. @ 35¢/qt		$ 56
Parts & Repairs		
Labor - 50¢/operating hour		
Parts - $1.00/operating hour		
Total $1.50/operating hour		
3640 hrs x $1.50		$ 5,460
Uniforms (10 per week)		$ 400
Equipment Lot Rental ($50/month)		$ 600
Insurance		$ 800
Miscellaneous		$ 400
TOTAL		$33,556

* Based on 5 yr. life @ 8% interest


Dent County
Prepared by Meramec Regional Planning Commission
Source General Highway Map Missouri State Highway Dept 1972
Date 6-74
Scale of miles
N
Area "A" 280 Households
Area "B" 220 Households
Area "C" 265 Households
Area "D" 285 Households
Area "E" 265 Households
Area "F" 245 Households
Area "G" 215 Households
Area "H" 220 Households
Area "I" 210 Households
Clark National Forest
Meramec River
Current River
Salem
Montauk State Park

MAILBOX COLLECTION SERVICE AREAS

Fig. D-5

MONTHLY COLLECTION USER COST

Monthly Cost -------- $32,719/12 mo. ---- = $ 2726 / month
Cost Allocated to Regular Service
$2726 x .95 -------------------- = $ 2589
Cost Allocated to Special Pick-Up
$2726 x .05 -------------------- = $ 137

Monthly Collection User Cost
With 90% participation (2091 services)
$2589/2091 -------------------- = $ 1.24 / user
With 80% participation (1859 services)
$2589/1859 -------------------- = $ 1.40 / user
With 70% participation (1626 services)
$2589/1626 -------------------- = $ 1.60 / user
With 50% participation (1162 services)
$2589/1162 -------------------- = $ 2.23 / user
With 40% participation (930 services)
$2589/930 -------------------- = $ 2.79 / user

Disposal Cost-- Since the proposed landfill will be relatively small, the disposal cost portion will be sensitive to each user that is added to the system. The more people that use the new landfill, the lower the per user cost will be. Below is shown how the user cost will vary with the different percentages of participation. It is assumed that Sanitary Landfill Plan B will be established.

ANTICIPATED DISPOSAL COST
(Based on Salem Landfill Plan "B")

Monthly Disposal User Cost
- With 90% Participation:
  - 2130 tons per year generation
  - $7.58/ton disposal charge
  - 64¢/user/month disposal user charge
- With 80% Participation:
  - 1893 tons per year generation
  - $7.97/ton disposal charge
  - 67¢/user/month disposal user charge
- With 70% Participation
  - 1657 tons per year generation
  - $8.39/ton disposal charge
  - 71¢/user/month disposal user charge
- With 50% Participation:
  - 1184 tons per year generation
  - $9.39/ton disposal charge
  - 79¢/user/month disposal user charge
- With 40% Participation:
  - 947 tons per year generation
  - $9.78/ton disposal charge
  - 83¢/user/month disposal user charge

Management and Billing Cost-- The cost of providing management, personnel support, and billing is shown below. The costs were developed as if the county would be operating the system, but would be similar if a contractor was used.

ANNUAL MANAGEMENT AND BILLING COST

I. Administrative Cost

	Annual Cost
County Manager (County Court)----------------	$ 1,500
Mileage & Expenses -----------------------	$ 500
Supervisor - $10,000 Annual (25% of time) ---	$ 2,500
Subtotal	$ 4,500

II. Billing Cost (Quarterly Billing)

Billing Clerk - $4,000 Annual plus 25% fringe - 25% of time ----------	=	$ 1,250
Building Rent ($50/month) -----------------	=	$ 600
Mailing Cost - 10¢/bill - 4/yr.		
With 90% participation (2091 x .10 x 4)	=	$ 837
With 80% participation (1859 x .10 x 4)	=	$ 744
With 70% participation (1626 x .10 x 4)	=	$ 651
With 50% participation (1162 x .10 x 4)	=	$ 465
With 40% participation (930 x .10 x 4)	=	$ 372

III. Personnel Support

Average Time-off per Year

Sick Leave	8 days	64 hrs.
Vacation	10 days	80 hrs.
Holidays	7 days	56 hrs.
		200 hrs./man/yr.

Annual Cost for Personnel Support
200 hrs x 2 men x 3.94/hr. ---------- = $ 1,576

IV. Monthly Management & Billing User Cost

90% participation - 35¢
80% participation - 39¢
70% participation - 44¢
50% participation - 60¢
40% participation - 75¢

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GASCONADE COUNTY SOLID WASTE MANAGEMENT PLAN

Background

Purpose-- Gasconade County is experiencing considerable changes as people and businesses are migrating here from the Metropolitan areas. One of the many problems that accompanies this growth is solid waste disposal. Most of the people moving into this area are accustomed to waste disposal services which are presently not available in a large part of the rural areas. Those living on small parcels of land are then faced with the problem of where to get rid of the trash. Unfortunately, the only alternatives these people are given are to use one of the privately operated open dumps, a roadside promiscuous dump, or someone else's field. This plan has been written to propose a solution to problems which exist when residents are required or allowed to use unsanitary dumps as the only means of refuse disposal. The intent of this plan is to lay the framework for a fair, economical refuse service which will serve all the residents of Gasconade County. The plan is also intended to meet the planning requirements of the Missouri Solid Waste Management Act of 1972 for Gasconade County and the cities of Bland, Gasconade, Hermann, Morrison, Owensville, and Rosebud.

Background Data-- Information on population, housing, and businesses from the 1970 Census and MRPC Surveys is listed below.

	Population	Occupied Housing Units	Persons/ Housing Unit	Housing Units w/1 Person	Est'd No.of Business	Industries
Gasconade Co.	11,878	4,231	2.8	832	NA	NA
Unincorporated	5,409	1,793	3.1	253	NA	NA
Bland	621	257	2.4	80	25	3
Gasconade	235	94	2.5	29	5	--
Hermann	2,658	985	2.7	238	140	7
Morrison	234	84	2.8	17	84	--
Owensville	2,416	909	2.7	195	132	4
Rosebud	305	109	2.8	20	20	2

Solid Waste Steering Committee-- Two years before the State required Solid Waste Plans were due, the Mayors and County Court Judges in Gasconade County began work on their plan. The first step was a meeting sponsored by the University of Missouri Extension Division with all the Mayors, Councilmen, and County Court invited. Types of solid waste management systems available were discussed at this meeting.

The next step was to hold county public meetings in several locations in the county. At these meetings the various types of refuse collection and disposal systems that could be used were discussed. Much valuable information concerning the type of services the people wanted came from these discussions.

During one of these meetings it was decided that the best approach to drafting the solid waste plan was the formation of a County Steering Committee. Members of the committee are listed below:

Gasconade Solid Waste Steering Committee Members

Henry Aufderheide	Associate Judge
C.M. Bassman	Mayor-City of Hermann
Kenneth Bohl	Mayor-City of Rosebud
Marvin Bruens	M.F.A.
Willard Cautrell	Mayor-City of Bland
Raymond Haeffner	Mayor-City of Gasconade
H.F. Hoener	Presiding Judge
Wilbert Idel	Associate Judge
Victor Jett	Former Mayor-City of Bland
Taft Mathews	Farm Bureau
Wesley Michel	Mayor-City of Owensville
Albert Rohlfing	Mayor-City of Morrison
Lloyd Rohlfing	N.F.O.
John Vanderwerken	Former Mayor-City of Gasconade

Ex-Officio Members

John Ballard	University of Mo.-Extension Div.
Karl Freese	Meramec Regional Planning Comm.

Recommendations of the Committee

Introduction-- After a year and a half of numerous meetings the Steering Committee has developed a recommended Solid Waste Management Plan. Each City Council and the County Court must officially adopt this plan before it will satisfy the State Planning requirements. Whenever a city or the county wishes to amend their plan it can be done by writing the State Department of Natural Resources. The recommendations of the Committee are in the following sections.

Management-- The management of the disposal sites will be the responsibility of the County Court. Policy decisions pertaining to the operation of the disposal sites will be made with advice from a Citizen Solid Waste Advisory Committee. The Committee will have twelve representatives', one from each of the cities and six selected from the unincorporated area of the county.

A county coordinated bid will be let for refuse collection. The supervising of the contract will be the responsibility of the respective city or county. The individual responsible for supervising the contract and ordinances will be the respective Mayor or Presiding Judge.

Storage-- On-site storage of solid waste will be regulated by city ordinance in the incorporated areas and court order in the unincorporated area. The ordinance and court order will be developed to meet the State requirements mentioned earlier in this plan pertaining to storage containers.

Collection-- Each household, business, and industry in the four cities will be required to have refuse collection service. A minimum of once-per-week collection will be required. In the incorporated areas, refuse collection will be regulated by city ordinance and will meet the requirements of the state also mentioned previously.

Residents of the unincorporated area of the county will be given three options. The first will be to dispose of their own waste on their own property as long as they meet the requirements of the Missouri Solid Waste Management Act. The second option will be to use the bulk containers which will be located throughout the county. The final option will be given to those who live along the regular scheduled routes of the contractor. These people can elect to subscribe to the county mailbox collection system. The operation of the collection system will be regulated by county court order and will meet the sanitary requirement of the State.

Disposal-- Disposal of all solid waste will be in State approved sanitary landfills leased or owned by the County. The County would then be reimbursed on an equitable basis by everyone using the landfill. The sites will be operated either by the

County or a contractor. Two abandoned fire clay pits are presently being considered to be used as landfills. The approximate location of both pits is shown in Figure . Both sites have been given preliminary approval from the Missouri Geological Survey, but must be reinspected when they are pumped dry. The sites being considered should last a minimum of five years. There are a sufficient number of fire clay pits in the area to use almost indefinitely.

It is hoped that by using clay pits as disposal sites, a broader range of special problem wastes such as oil sludges, could be handled than in a convential landfill. This subject will be addressed in greater detail in the engineer's plans of each site. With the exception of a clay mining residue waste from Allied Chemical Corporation in Owensville few special problem wastes were discovered in the study. It is our understanding that engineers from Allied Chemical are developing plans for their special waste.

Financing-- As will be shown in the cost analysis, the county containerized or green-box system is one of the most economical types of refuse service available. The main drawback is that there is no way of telling who is using the service and who isn't. For this reason everyone in the county that doesn't have his trash collected at his property must help pay for the service.

At the public meetings people indicated strongly that they would prefer paying for the service by a service charge rather than a tax. Since the tax is on the assessed valuation it was felt it would be unfair since the amount an individual paid would not reflect the service he received. In the cities, the refuse service charge will be included on the same bill as the utilities, while in the unincorporated areas a special billing must be made. Much work has already been done on establishing a billing system using existing utility mailing lists.

Capital financing of the systems will be the responsibility of the contractor. However, the bidders will be told that there are government subsidized loans available.

Long-Range Plans-- After the system is in operation and has had time to become established, it is intended to make a time and cost study of the total operation. This study will be checked against the time and cost projections made in this report. Through this effort better plans will be able to be made which will result in more economical systems in the future. As the contracts come due, alternate systems will be considered. If contracting with a private contractor becomes too expensive, consideration will be given to a joint municipal-county operated system. As Union Electric's Energy Recovery Project is developed, consideration will be given to establishing a transfer station and hauling into this project. Serious consideration should also be given to the areawide management system mentioned in the Planning Section of this report.

Implementation Schedule

July 1974-- Solid Waste Management Plan adopted.

July through December 1974-- A public information program will be conducted explaining the new system. All cities will have adopted uniform collection ordinances and the county coordinated bid will have been let. A County Court order will have been adopted regulating solid waste operations in the unincorporated areas. The landfills will begin operation.

December through June 1975-- The county collection system will be put into operation.

Solid Waste Management System Design

Introduction-- Since there are no county containerized collection systems operating in Missouri it was necessary to develop a routing analysis and typical annual cost for the Gasconade County system. Since Gasconade, Hermann and Morrison already have uniform collection systems in operation, a routing analysis was not necessary. A routing analysis and typical annual cost was developed for a Bland, Owensville, and Rosebud route. The cost developed for the Bland, Owensville and Rosebud route should be representative of the county. The typical annual cost projections should be used as a guide when examining the contractors bid.

Summary-- Table G-1 is a summary of the projected user cost.

Table G-1

Gasconade County Solid Waste Management System

Projected Monthly User Cost

COUNTY CONTAINER SERVICE	COLLECTION		DISPOSAL	MANAGEMENT & BILLING	CONTINGENCY	TOTAL MONTHLY COST
	.37	cont. rental .14	.33	.19	.20	$1.23
City Collection						
Residential	1.49		.75	.27		2.51
Commercial						
Curbside	1.49		1.50	.27		3.26
1 cu.yd. cont.	9.72		7.00	2.00		18.72
2 cu.yd. cont.	10.27		14.00	4.00		28.27

Design Data-- In the routing analysis a comparison was made between a 13 cu.yd. and a 20 cu.yd. compactor truck. Due to weight limitations and operating cost, the 13 cu.yd. truck was favored. Table G-2 is the design data used in developing the municipal routing analysis. Refuse generation is based on the results of the Minimum Sampling Program, and the loads per week assume a density of 700 lbs/cu.yd. The estimated collection time reflects only the time spent on routes in the communities. To obtain this data time studies were made on several collection operations in the Region. The estimated collection time is based on minutes per residential service and two minutes per container stop. This assumes twice-per-week, curbside collection, with a two-man crew. Another study is planned after the system is in operation to check the time projections.

Municipal Routing Schedule-- Figure G-1 indicates a proposed routing schedule to serve the cities of Bland, Owensville, and Rosebud. To optimize manpower and equipment, a forty-hour, four-day, work-week was used. As indicated in Figure G-1 a two-man crew is completely utilized serving Bland, Owensville and Rosebud.

Typical Annual Cost-- The typical annual cost for the municipal collection route is shown below.

TYPICAL ANNUAL COST FOR BLAND, OWENSVILLE, ROSEBUD COLLECTION ROUTE

	Initial Cost	Annual Cost
I. Equipment Investments		
13 cu.yd. Compactor Truck (w/overhead wench & C.B. Radio)	$ 14,000	$ 3,507*
Containers**		
1 cu.yd. - 40 containers @$150 ea.	6,000	$ 2,329**
2 cu.yd. - 14 containers @$170 ea.	2,380	924**
Subtotal (less containers)		$ 3,507
II.. Personnel		
Driver - $3.50/hr. adjusted***		$ 9,107
Collector - $3.00/hr. adjusted***		$ 7,800
		$16,907

* Annual Cost computed on 5 yr. life @ 8% interest
** Annual Cost computed on 3 yr. life @ 8% interest
*** Adjusted Salary includes Soc.Sec., Hospitalization, Unemployment Insurance, Vacation and Sick Leave.

TABLE G-2 : MUNICIPAL COLLECTION SYSTEM DESIGN DATA

	Bland	Gasconade	Hermann	Morrison	Owensville	Rosebud
Weekly Refuse Generation Residential (lbs)	9,564	3,619	48,515	3,604	42,280	4,697
Commercial (lbs)	2,174	832	14,805	809	13,530	1,068
Industrial (lbs)	N.A.	--	20,560	--	6,680	N.A.
Total (lbs)	11,738	4,442	81,960	4,423	62,490	5,765
Annual Refuse Generation(ton)	306	116	2,131	115	1,625	150
Av. Refuse per Collection Pd. (twice per week)	6,691	2,538	46,800	2,540	38,680	3,300
Loads per Collection Period 13 cu.yd. Compactor	.75	.3	6	.3	4	.4
20 cu.yd. Compactor	.5	.2	4	.2	3	.25
Est. Collection Time Residential	140 min.	50 min.	660 min.	50 min.	500 min.	60 min.
Containers	20 min.	--	60 min.	--	60 min.	--
Total Est. Collection Time	2.6 hrs.	50 min.	12 hrs.	50 min.	9.3 hrs.	1 hr.

Fig. G-1: WEEKLY VEHICLE ROUTING SCHEDULE

BLAND OWENSVILLE, ROSEBUD [illegible]

Time / Day	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
6:00 AM							
7:00		OWENSVILLE	OWENSVILLE		OWENSVILLE	OWENSVILLE	
8:00			↓			↓	
9:00		↓	[illegible]		↓	DISPOSAL @ [illegible]	
10:00		DISPOSAL OWENSVILLE	↓		DISPOSAL OWENSVILLE		
11:00		↓	[illegible]		↓	↓ [illegible]	
12:00		LUNCH	[illegible]		LUNCH	LUNCH	
1:00 PM		OWENSVILLE	[illegible]		OWENSVILLE	BLAND	
2:00		↓ DISPOSAL			↓ DISPOSAL		
3:00		OWENSVILLE			OWENSVILLE		
4:00		↓ DISPOSAL	↓ DISPOSAL		↓ DISPOSAL	↓ DISPOSAL	
5:00		MAINTENANCE	MAINTENANCE		MAINTENANCE	MAINTENANCE	
6:00							

III. Operating Expenses

	Annual Cost
Gasoline - 1820 hrs. x 2.3 gallons/hr. @ 50¢ per gallon	$ 2,093
Oil - 1820 hr. @ .04 qt/hr @ 35¢/qt	$ 26
Parts and Repairs Repair - labor - 50¢/operating hr. Repair - parts - $1.00/operating hr. $1.50 per operating hr x 1820 hrs. =	$ 2,730
Uniforms (10 per week)	$ 400
Equipment lot rental (100/month)	$ 1,200
Insurance	$ 400
Miscellaneous	$ 400
Subtotal	$ 7,242
Annual Cost (less containers)	$27,663

COST ALLOCATIONS

City	Time For Curbside Collection	Time For Container Collection
Owensville	500 min.	60 min.
Bland	140	12
Rosebud	60	
	700	72

Total Time: 772 min.

Percent for Curbside - 700/772 = 91%
Percent for Containers - 72/772 = 9%

Cost Allocated to Curbside Collection
.91 x $27,663 = $ 25,174
Cost Allocated to Containers
.09 x $27,663 = $ 2,490

Monthly Service Charge
Curbside --- No. of services - 1,409

Monthly Curbside Service Charge
$ 25,174 ÷ 12 ÷1409 = $ 1.49

Containers (No. of containers) - 54

Monthly Service Charge
2490 ÷ 12 ÷ 54 = $ 3.84

Container Rental

1 cu.yd. - $2329/12/34	=	$ 5.88
2 cu.yd. - $ 924/12/12	=	$ 6.43

Monthly Container Collection Cost

1 cu.yd - $9.72

2 cu.yd. - $10.27

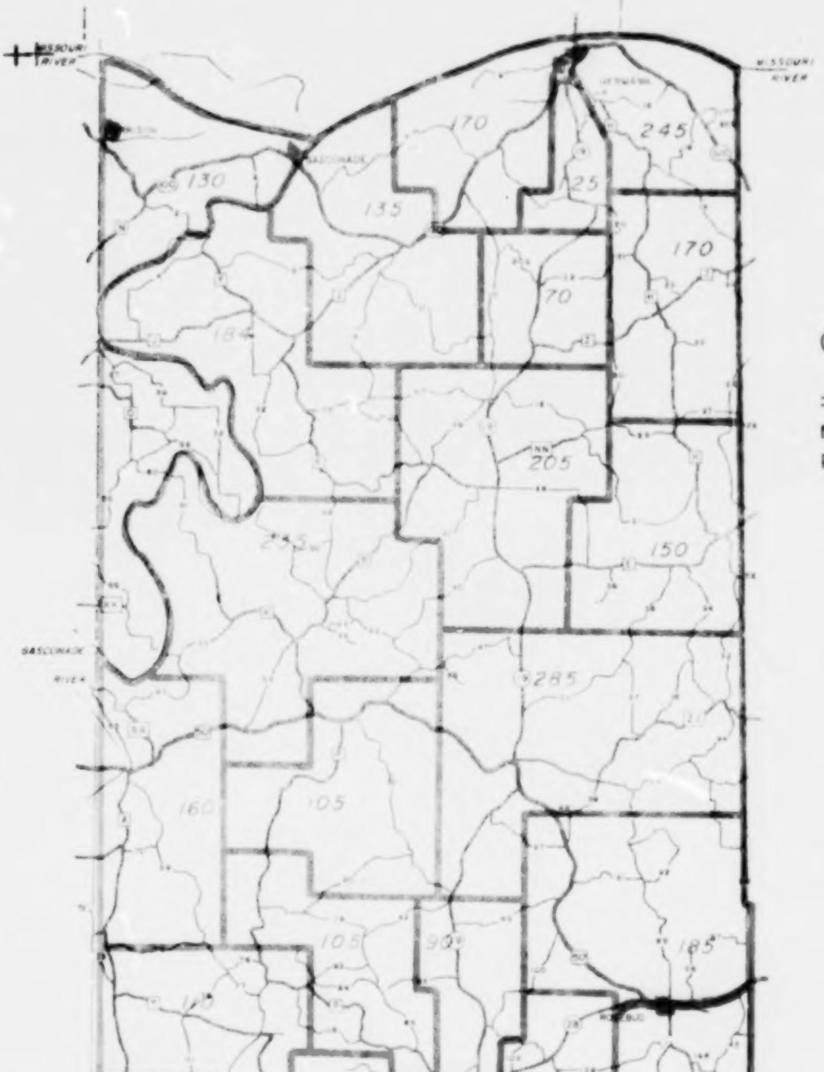
County Bulk Container Locations-- It was calculated that 50-four cubic yard containers would be required to service the entire county. This assumes everyone in the unincorporated areas participates, 1.5#/person/day generation, twice per week collection, 200#/cu.yd. density and the containers not exceeding 80% full when emptied. With these assumptions it was also calculated that a four cubic yard container would serve 106 persons. Finally, it was calculated that a 13 cu.yd. compactor truck should be able to serve 1500 persons/load and a 20 cu.yd. truck serve 2300 persons/load. Container sites were not located for it was felt that this could best be done by the Steering Committee through public hearings. However, the county was broken down into 30 general service areas as shown in Figure G-2, and the population was estimated for each area. It is recommended that, wherever possible, the containers be located on parking lots of stores, gas stations, feedmills, churches, or parks to reduce site development cost.

County Container Routing Analysis-- Figure G-3 and Figure G-4 indicate the routes and route schedules for a 13 cu.yd. truck and Figure G-5 and G-6 for a 20 cu.yd. truck.

GENERAL POPULATION AREAS

NUMBERS INDICATE APPROX. POPULATION IN AREAS

Fig. G-2


MISSOURI RIVER
MISSOURI RIVER
HERMANN
GASCONADE
GASCONADE RIVER
BLAND
OWENSVILLE
ROSEBUD
BOURBEUSE RIVER
130
135
170
25
245
170
70
184
205
150
255
285
160
105
105
90
185
110
175
185
170
125
250
175
160
250
230
125
150
80
290
N
SCALE OF MILES

Gasconade County

PREPARED BY
MERAMEC REGIONAL PLANNING COMMISSION

SOURCE
GENERAL HIGHWAY MAP
MISSOURI STATE HIGHWAY DEPARTMENT 1971

DATE
6-74

Fig. G-3

WEEKLY VEHICLE ROUTING SCHEDULE

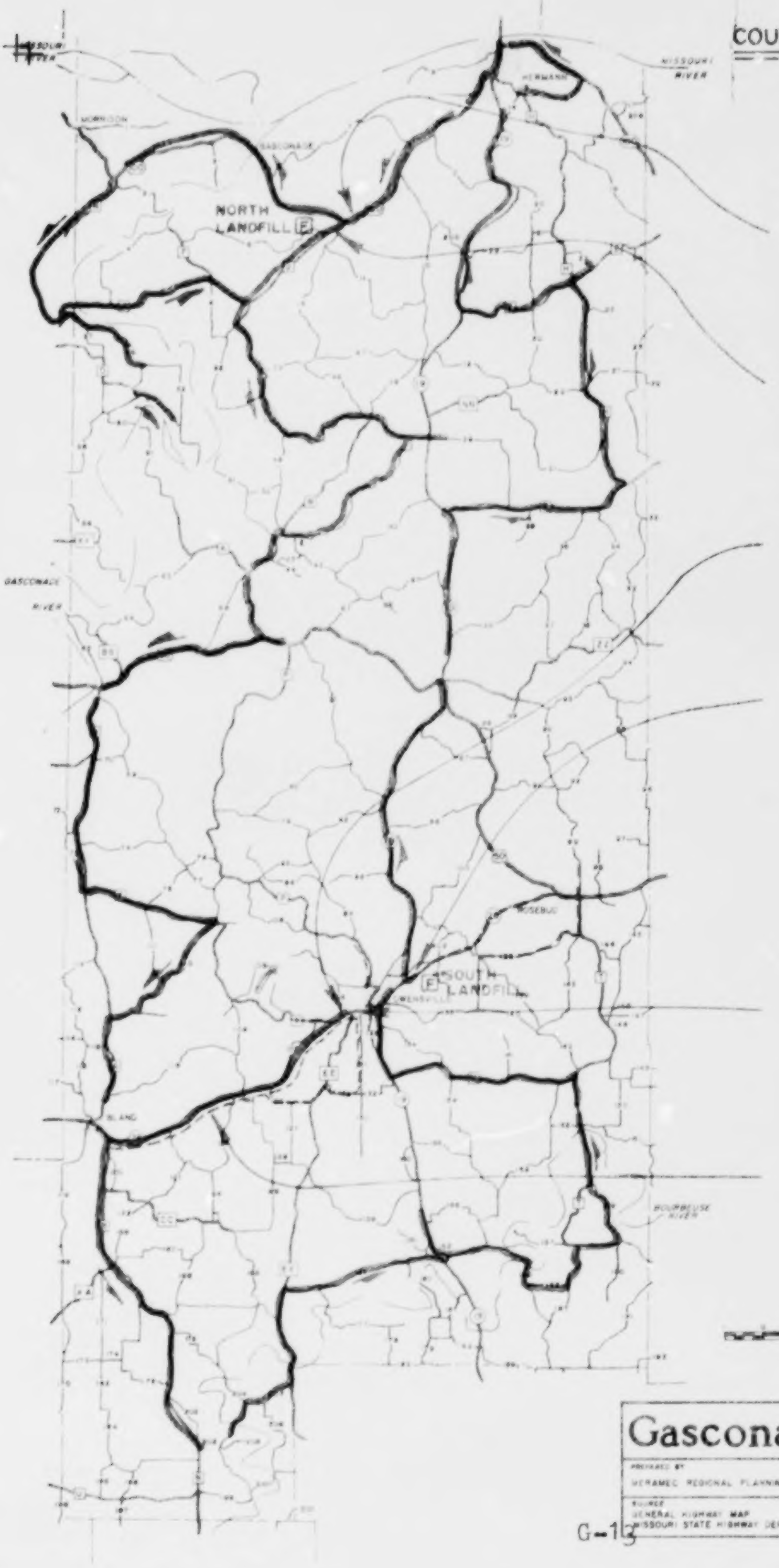
G[illegible]ALE COUNTY [illegible] - 13 CU YD PACKER

Time / Day	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
6:00 AM							
7:00			DRAKE, STONY HILL ROUTE	COUNTY [illegible] - TO - [illegible] ON VEHICLE [illegible] TOWN PICK-UP		DRAKE STONY HILL ROUTE	[illegible] ON [illegible] TOWN PICK-UP
8:00			↓ DISPOSAL N. LANDFILL			↓ DISPOSAL N. LANDFILL	
9:00			PERSHING LOOP			PERSHING LOOP	
10:00			↓ DISPOSAL N. LANDFILL			↓ DISPOSAL N. LANDFILL	
11:00			BAY MT STERLING, NEW WOOLAM ROUTE			BAY MT STERLING, NEW WOOLAM ROUTE	
12:00			↓			↓	
1:00 PM			LUNCH			LUNCH	
2:00			DISPOSAL S. LANDFILL REDBIRD, BEM,			DISPOSAL S. LANDFILL REDBIRD, BEM,	
3:00			TEA ROUTE			TEA ROUTE	
4:00			↓ DISPOSAL S. LANDFILL			↓ DISPOSAL S. LANDFILL	
5:00			MAINTENANCE	↓		MAINTENANCE	↓
6:00							

COUNTY COLLECTION ROUTE

13 Cu Yd. COMPACTOR

Fig. G-4


MISSOURI RIVER
MISSOURI RIVER
HERMANN
MORRISON
GASCONADE
NORTH LANDFILL
E
GASCONADE RIVER
ROSEBUD
E
SOUTH LANDFILL
OWENSVILLE
BLAND
BOURBEUSE RIVER
N
SCALE OF MILES

1st. Load Mileage 40miles
Est. No. People Served 1305

2nd Load Mileage 29miles
Est No People Served 659

3rd Load Mileage 56miles
Est. No. People Served 1170

Start Route "A"

4th Load Mileage 52miles
Est No People Served 1055

Route "B"
Collected with Cities' Route
Est. No. People Served 1240

Gasconade County

PREPARED BY
MERAMEC REGIONAL PLANNING COMMISSION

SOURCE
GENERAL HIGHWAY MAP
MISSOURI STATE HIGHWAY DEPARTMENT 1971

DATE
6-74

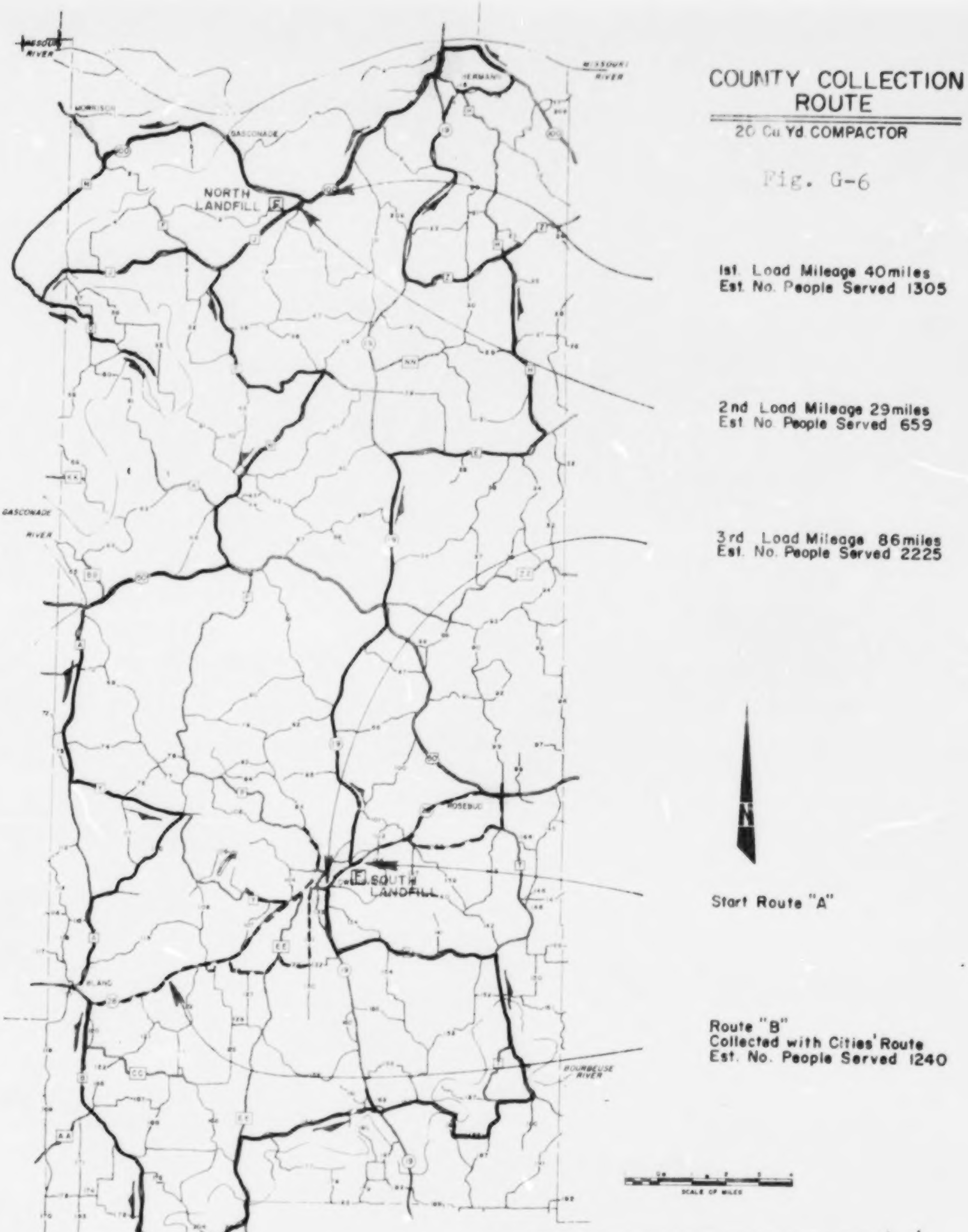
Fig. G-5

WEEKLY VEHICLE ROUTING SCHEDULE

GASCONADE COUNTY RUN – 20 CU YD PACKER

Time / Day	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
6:00 AM							
7:00			DRAKE, STONY HILL ROUTE	[illegible]		DRAKE, STONY HILL ROUTE	[illegible]
8:00			↓ DISPOSAL N LANDFILL			↓ DISPOSAL N LANDFILL	
9:00			PERSHING LOOP			PERSHING LOOP	
10:00			↓ DISPOSAL N LANDFILL			↓ DISPOSAL N LANDFILL	
11:00			BAY, MT STERLING, NEW HAVEN, ROSEBUD			BAY, MT STERLING, NEW HAVEN, ROSEBUD	
12:00			BEM, TEA ROUTE			BEM, TEA ROUTE	
1:00 PM			LUNCH			LUNCH	
2:00			↓			↓	
3:00			DISPOSAL S LANDFILL MAINTENANCE			DISPOSAL S LANDFILL MAINTENANCE	
4:00							
5:00			↓	↓		↓	↓
6:00							

Reproduced from best available copy.


MISSOURI RIVER
MISSOURI RIVER
HERMANN
MORRISON
GASCONADE
NORTH LANDFILL
GASCONADE RIVER
ROSEBUD
SOUTH LANDFILL
BLAND
BOURBEUSE RIVER
SCALE OF MILES

COUNTY COLLECTION ROUTE

20 Cu.Yd. COMPACTOR

Fig. G-6

1st. Load Mileage 40 miles
Est. No. People Served 1305

2nd Load Mileage 29 miles
Est. No. People Served 659

3rd Load Mileage 86 miles
Est. No. People Served 2225

Start Route "A"

Route "B"
Collected with Cities' Route
Est. No. People Served 1240

Gasconade County

PREPARED BY
MERAMEC REGIONAL PLANNING COMMISSION

SOURCE
GENERAL HIGHWAY MAP
MISSOURI STATE HIGHWAY DEPARTMENT 1971

DATE
8-74

Typical Annual Cost for County Containerized System

Typical Annual Cost

A. 13 cu.yd. Compactor Truck

Equipment Investments	Initial Cost	Annual Cost
13 cu.yd. compactor truck*	$ 15,000	$ 3,757
(with overhead wench, radio, and pressure cleaning unit.)		
Containers**		
50 - 4 cu.yd. @ $300 ea.	$ 15,000	$ 4,820
Personnel		
Driver - Collector ($3.50/hr.)		$ 9,107
(plus Soc.Sec., hospitalization, unemployment, vacation and sick leave)		
Operating Expenses		
Gasoline - 1820 hrs x 2.3 gal.per.hr. @ 50¢ per gal.		$ 2,093
Oil - 1820 hrs. @ .04 qt./hr. @ 35¢/qt.		$ 22
Parts and Repairs		
a. Repair labor 50¢ per op.hr. b. Repairs-parts $1.00 per op.hr. Total $1.50/hr. 1820 @ 1.50		$ 2,730
Uniforms (5 per wk)		$ 200
Lot Rental - $100/month		$ 1,200
Insurance		$ 400
TOTAL (Less Containers)		$ 19,509

* Annual Cost computed on 5 yr. life @ 8% interest
** Annual Cost computed on 3 yr. life @ 8% interest

Cost Allocation

Number of Billings ------------- 3,241
Assume 90% will pay ----------- 2,917 - bills collected

77% of residents on Route A = 2,246

Collection Cost allocated to Gasconade Co.
19,091 ÷ 2 = $ 9,546

Monthly User Fee
$9,546 ÷ 12 mo. ÷ 2,246 users = 36¢

Container Rental
$4,880/12/2,917 = 14¢

B. 20 cu.yd. Compactor Truck

Equipment Investment	Initial Cost	Annual Cost
20 cu.yd. compactor truck* (with tandum wheels, overhead wench, radio, and pressure cleaning unit)	$ 25,000	$ 6,262
Containers ** 50 -4 cu.yd. @ $300 ea.	$ 15,000	$ 4,820
Personnel		
Driver - Collector @ $3.50 per hr. (plus soc.sec., insurance, and personnel burden)		$ 8,750
Operating Expenses		
Gasoline - 1820 hr. x 4.5 gal.per hr. @. 50¢ per gal.		$ 4,095
Oil - 1820 hrs. @ .04 qt./hr. @ 35¢ qt.		$ 22
Parts and Repairs Repair labor - $1.00 per operating hr. Repair parts - $2.00 per operating hr. $3.00 per hour x 1820 hrs.		$ 5,460
Uniforms (5 per week)		$ 200

* Annual cost computed on 5 yr. life A 8% interest.
** Annual cost computed on 3 yr. life @ 8% interest.

Operating Expenses (cont.)	Annual Cost
Equipment lot rental @ $100/month	$ 1,200
Insurance	$ 400
TOTAL ANNUAL BUDGET (less containers)	$26,389

COST ALLOCATION

Collection Cost Allocated to Gasconade County
$26,389/2 = $13,135

Monthly User Fee
$13,135 ÷ 12 months ÷ 2,246 users = 49¢

Monthly Container Rental
4880 ÷ 12 ÷ 2917 = 14¢

GASCONADE COUNTY SOUTH SANITARY LANDFILL

Typical Annual Budget

I. Capital Cost	Initial Cost	Annual Cost
941-B Track-type Loader $4.47* x 1560 hrs./yr.	$ 29,000	$ 6,974
3" Sump Pump	$ 1,000	$ 251
Office Trailer 8% int. on 5 yr. life	$ 1,000	$ 251
Sewage Lagoon 8% int. on 5 yr. life	$ 500	$ 126
Well 8% int. on 5 yr. life	$ 1,000	$ 251
Engineering 8% int. on 5 yr. life	$ 5,000	$ 1,253
TOTAL CAPITAL COST	$ 37,500	$ 9,106
II. Operating Expenses		
Equipment Operator - $3.50/hr. (plus Soc.Sec., hospitalization, unemployment, vacation and sick leave)		$ 9,107

* see Attachment 1

Operating Expenses (cont.)	Annual Cost
Loader Operating Expenses 4.27* x 1560 hrs./yr.	$ 6,662
Uniforms (5 per wk.)	$ 200
Utilities - $80/month	$ 960
Phone - $20/month	$ 240
Insurance	$ 200
Misc. - $50/month	$ 600
TOTAL OPERATING EXPENSES	$ 17,969
TOTAL ANNUAL BUDGET	$ 27,075

* see Table G-3

GASCONADE COUNTY NORTH SANITARY LANDFILL

Typical Annual Budget

I. Capital Cost	Initial Cost	Annual Cost
941 - B Track-type Loader $4.47* x 1248 hrs. (6 hrs/day-3 days/wk)	$ 29,000	$ 5,683
3" Sump Pump 8% int. on 5 yr. life	$ 1,000	$ 250
Engineering 8% int. on 5 yr. life	$ 3,000	$ 752
TOTAL CAPITAL COST	$ 33,000	$ 6,685

II. Operating Expenses	
Equipment Operator - $3.50/hr. (plus benefits) 8 hr. day-3 day/week	$ 5,465
Loader Operating Expenses 4.27* x 1248 hrs.	$ 5,340
Insurance	$ 200
Misc. - $50/month	$ 600
TOTAL OPERATING EXPENSES	$ 11,605
TOTAL ANNUAL BUDGET	$ 18,290

* see Attachment 1

Table G-3

HOURLY OWNING AND OPERATING COSTS

Machine Designation . . . . 941-B Track-type Loader

DEPRECIATION VALUE

1. Delivered Price (including attachments) . . $ 29,000
2. (Optional) Less Resale Value or Trade-In. . $ 0
3. Net Value for Depreciation. . . . . $ 29,000

OWNING COSTS

4. Depreciation: $\frac{\text{Net Depreciation Value (Item 3)}}{\text{Depreciation Period in Hours}}$

   $\frac{\text{Value}}{\text{Hours}}$ $\frac{\$29,000}{10,000}$ . . . . $ 2.90

5. Interest, Insurance, Taxes:
   Annual Rates: Int. 8 %, Ins. 3 %, Taxes 2 %.
   Estimated Annual Use in Hours-1560-6 hr/day x 260 days/hr

   Factor x Delivered Price (Item 1)

   $\frac{.054 \times \$29,000}{1000}$ . . . . $ 1.57

6. TOTAL HOURLY OWNING COSTS . . . . $ 4.47

OPERATING COSTS

   Unit Price x Consumption

7. Fuel: $.25 x 3.4 . . . . $ 0.85
8. Lubricants, Filters, Grease . . . . $ 0.12
9. Repairs: $\frac{\text{Factor x Del. Price}}{1000}$

   $\frac{.09 \times \$29,000}{1000}$ . . . . $ 2.61

10. Special Items:
    Tips 0.42¢
    Shank Protectors 0.27¢ . . . . . . $ 0.69
11. TOTAL HOURLY OPERATING COSTS . . . . $ 4.27
12. Operator's Hourly Wage . . . . ______
13. TOTAL HOURLY OWNING AND OPERATING COSTS . . $ 8.74

GASCONADE COUNTY LANDFILL COST ALLOCATION

TYPE OF SERVICE	AVG. WKLY. REFUSE (lbs)	% OF TOTAL	ANNUAL COST ALLOCATION	NUMBER OF BILLINGS	MONTHLY USER FEE
Containerized	56,795	25%	$ 11,341	2,917	33¢
Residential	110,279	48%	$ 21,775	2,434	75¢
Commercial	33,289	15%	$ 6,805		
Industrial	27,240	12%	$ 5,444		
Total	227,603	100%	$ 45,365		

MANAGEMENT AND BILLING

Typical Annual Budget

Gasconade County Solid Waste Management System (Semi-Annual Billing)

Administrative Cost	Annual Cost
County Administrator	$ 2,000
Mileage, Phone, etc.	$ 500
Billing Cost	
Billing Clerk - $4,000 Annual-50% of time	$ 2,000
Mailing - 2917 x 8¢ x 2	$ 467
Miscellaneous Supplies	$ 200
Professional Services (Legal Engineering, etc.)	$ 1,400
TOTAL (Less Billing Machine Rental)	$ 6,567

Monthly User Service Charge
$6567 ÷ 12 months ÷ 2917 = 19¢ per month

City Solid Waste Management System (Monthly Billing)
(Assuming 1000 billings per month)

Administrative Cost	Annual Cost
City Administrator	$ 1,000
Mileage, Phone, etc..	$ 250
Billing Cost	
Billing Clerk - $4,000 annual plus personnel burden - 25% of time	$ 1,250
Mailing - 1000 bills x 12 months x 10¢ x .25	$ 300
Miscellaneous Supplies.	$ 400
TOTAL	$ 3,200

Monthly Service Charge
$3200 ÷ 12 ÷ 1000 = 27¢

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MARIES COUNTY SOLID WASTE MANAGEMENT PLAN

Background

Purpose-- With the increased use of disposable items and prepackaged foods all communities are being faced with a growing solid waste problem. Even in small rural counties, such as Maries, solid waste management planning is necessary to ensure that everyone has a sanitary, economical place to dispose of his refuse. As pointed out in the section on "Reasons for Change" the old open dump can hardly be considered sanitary or economical, especially because it can be replaced by a sanitary landfill at a reasonable cost. The intent of this plan is to outline the best possible method, within present laws, of providing sanitary refuse collection and disposal services wherever they are needed. Also, it is the intent of this plan to meet the planning requirements of the Missouri Solid Waste Management Act for Maries County and the Cities of Belle and Vienna.

Background Data-- Population and housing data from the 1970 Census and MRPC Surveys is listed in Table M-I for Maries County and the cities of Belle and Vienna.

TABLE M-I

Maries County Housing Data

	Population	Occupied Housing Units	Persons/ Housing Unit	Housing Units with 1 Person	Industries
Maries Co.	6,851	2,283	3.0	404	11
Unincorporated	5,304	1,694	3.1	249	3
Belle	1,042	403	2.6	98	5
Vienna	505	186	2.7	57	3

Development of the Plan-- Even with a combined effort of Belle, Vienna, and Maries County, establishment of a county sanitary landfill would be very difficult. This is mainly because of the relatively low population supporting the landfill and because the geology and topography of much of the area is unsuitable for a landfill. It is fortunate, however, that there are three proposed landfills to be located within an economical hauling distance of all portions of Maries County. The northeast portion of the county can be served by the proposed landfill at Owensville; the center of the county by the Phelps County landfill; and the West part of the county by the proposed landfill at Dixon. Since the refuse would be hauled to three different areas by three contractors, it was felt that a joint effort among the cities and the county would have little advantage. For this reason both cities and the county have developed their plan on an individual basis.

Solid Waste Management Recommendations

Management-- All refuse collection and disposal operations will be operated by contract. The respective city councils will be responsible for letting the contracts in the cities and regulating the contractor's operations. The sanitary standards of the contractor in the county will be regulated by the County Court.

Storage-- On-site storage of solid waste will be regulated by city ordinance in the incorporated areas and court orders in the unincorporated areas. The ordinance and court orders will be developed to meet the State requirements pertaining to container design and sanitary conditions previously mentioned on page 55.

Collection-- Each household, business, and industry in the two cities will be required to have refuse collection services. A minimum of once-per-week, curbside collection will be required. Refuse collection in the incorporated areas will be regulated by city ordinance and will meet the requirements previously mentioned on page 59 that were established by the State.

There will be three levels of service in the unincorporated areas of the county. The first will be for residents to dispose of their own waste on their own property as long as they meet the minimum requirements of the Missouri Solid Waste Management Act. Second will be for individuals to take their refuse to one of the three landfill sites, and third will be for residents to contract with one of the private collectors to have their refuse collected at their mailbox. The contractor which is presently serving Vienna has a collection route established along the entire length of Highway 63 and has stated that he would be willing to expand the service into any area in which it is economically feasible.

Disposal-- Disposal of all solid waste will be in the three previously mentioned sanitary landfills which are to meet all the requirements of the State. No excessive number of special problem wastes that couldn't be handled with the conventional collection system were discovered in this study.

Financing-- Residents in the cities will be charged for refuse service on their municipal utility bill. In the unincorporated areas of the county, residents will be charged a service charge by a duly authorized agent of the County Court.

Future Plans-- As contracts come due, alternate methods of providing more efficient, economical refuse collection and disposal service will be examined. As rural collection systems are tried and found successful in other areas they will be considered for Maries County.

Implementation Schedule

Present-- A uniform collection system is in operation in the City of Vienna and rural collection routes are being established in the county with the refuse being hauled to Phelps County.

July 1974-- Solid Waste Management Plan adopted.

July through January 1975-- The City of Belle will have passed a uniform collection ordinance and contracted for refuse collection and disposal services. The County Court will have passed a court order regulating the sanitation of the refuse collection service in the County.

June 1975-- All dumps will be properly closed.

Solid Waste Management System Design

Municipal Collection-- Uniform, once-per-week, curbside collection has already begun in the City of Vienna for a reasonable user cost of $2.00 per month. The Belle City Council has announced plans to let a uniform collection contract to begin operation in January. Refuse from Belle will be taken to the Owensville landfill and the contract will probably be bid on by the same contractor as in Bland, Owensville and Rosebud. Since the same level of service is planned in Belle as in Bland, Owensville and Rosebud the user charge could be expected to be similar to the cost projections for those cities of $2.50 to $3.00 per month.

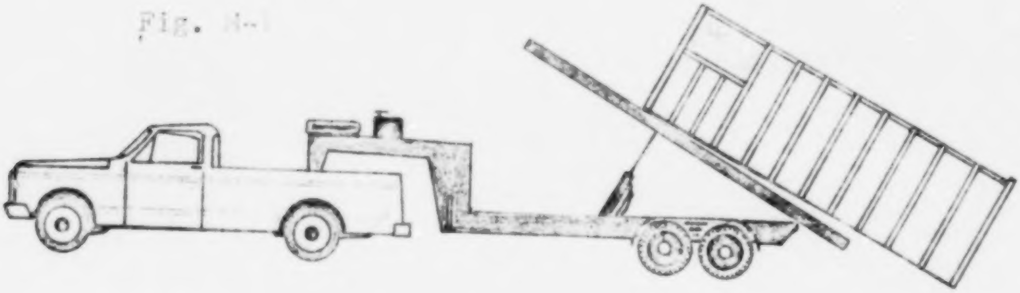
Collection in the Unincorporated Areas-- In conducting the Solid Waste Management Study it was noticed that Maries County had less problems with open dumping than any other county in the Region and the dumps in the County were generally kept in better condition than most dumps. It is felt that one reason for fewer dumps is that since there is a lower population density more people can properly dispose of their refuse on their own property.

Several types of refuse collection systems were discussed with the County Court, but, it was evident that the user charge for any type of system will be higher in Maries County because of the low population. A typical annual cost as shown in following section, was developed for a refuse collection system that is considered to have one of the lowest possible annual cost. Even this system could not be payed for by the revenue generated from the Solid Waste levy authorized by law. The only other means of financing would be through a service charge, but a county has no effective method of collecting a service charge.

Until it is proven on other more feasible systems that the service charge can be an effective method of financing a solid waste disposal system, Maries County should not attempt to establish a countywide collection system. If the State Legislature would authorize an effective method for counties to collect a service charge then a countywide collection system would probably be feasible.

Goose-Neck Roll-Off Container System-- This refuse collection system is composed of large bulk containers located at several sites throughout the county. The containers have a compaction unit which requires electrical power, therefore they must be placed at a service station or store where electricity is available. Also available must be an attendant to occasionally compact the load. The containers are serviced by bringing in an empty container on a goose-neck trailer that is pulled by a pick-up truck, as shown in Figure M-1. The full container is then loaded on the trailer and taken to a landfill, then being emptied, the container is taken on to the next site. One advantage to this system is the small amount of equipment required to begin operation.

Fig. M-1



Container Sizing-- It will be assumed that everyone in the county will participate in this system. The container size required is calculated as follows:

5304 persons x 1.5#/person/day x 4 day (max. collection period) =
31,824 lbs of trash per collection period.
12 cu.yd. Container size x 700 lbs/cu.yd. = 8,400 lbs/container
31,824 ÷ 8,400 = 3.8 containers or four containers required
plus one spare unit.

Container Collection Routing-- Four container site locations were assumed as shown in Figure M-2, with a routing system to service the containers developed and test driven. As a result, it was found that all the containers should be able to be serviced in one day.

Alternate System-- As an alternative, this system could be started with only two containers, located possibly at Vienna, to determine the public's reaction. A typical annual cost for collection and disposal of this alternate is estimated at $16,000, which could probably be financed by the Solid Waste Levy. It might be possible to finance this system by charging a service charge at the container, however, since this system would be competing with open dumps it is doubtful that sufficient revenue would be raised.

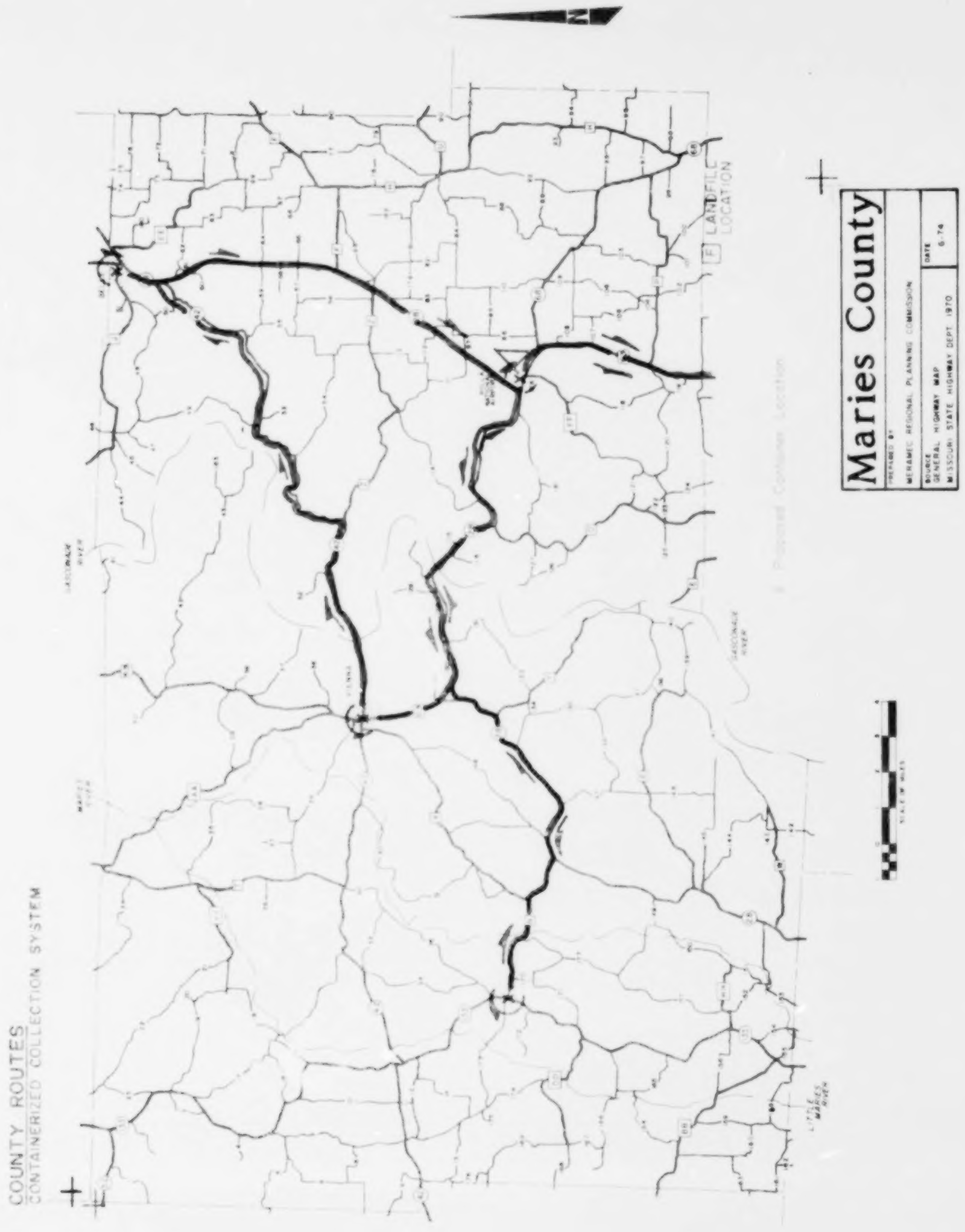

COUNTY ROUTES
CONTAINERIZED COLLECTION SYSTEM
Maries County
PREPARED BY
MERAMEC REGIONAL PLANNING COMMISSION
SOURCE
GENERAL HIGHWAY MAP
MISSOURI STATE HIGHWAY DEPT 1970
DATE
6-74
LANDFILL LOCATION
● Proposed Container Location
SCALE IN MILES
GASCONADE RIVER
MARIES RIVER
LITTLE MARIES RIVER
VIENNA
N

Fig. M-2

ROLL-OFF CONTAINER SYSTEM

Typical Annual Cost

Capital Cost	Initial Cost	Annual Cost
3/4 ton pick-up truck*	$ 3,500	$ 877
5 - Roll-Off Containers @$4,200 ea.*	$ 21,000	$ 5,260
1 - Roll-Off Flatbed Hauler **	$ 5,200	$ 2,018
Personnel Cost		
Driver - Loader $3.50/hr (adjusted 20 hrs.wk.)		$ 4,553
Operating Expenses		
Gasoline - 23,400 mi/yr @12 mi/gal & 50¢/gal.		$ 975
Oil		$ 25
Pick-up Truck Maintenance 5¢/mi.		$ 1,000
Container Maintenance - $20/cont./mo.		$ 960
Insurance		$ 600
Miscellaneous		$ 200
	TOTAL	$16,468

Annual Landfill Cost

Solid Waste Generation
5304 persons x 1.5 #/person/day x 365 days = 2,903,940 lbs. or 1,452 tons/yr.

Disposal Cost = 1452 x $5.00/ton = $ 7,260/yr.

Total Annual Collection & Disposal Cost = $23,728

Monthly User Cost (assume 2600 billings from county electric maps)

Assume 10% of billings uncollectable

2600 x .9 = 2340 collectable bills

User Cost for Collection and Disposal = 23,728/12 mo./2340 =85¢/user/mo.

* Annual Cost based on 8% interest - 5 yr. life
** Annual Cost based on 8% interest - 3 yr. life

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PHELPS COUNTY SOLID WASTE MANAGEMENT PLAN

Background

Purpose-- For sometime, in Phelps County, the cities and County Court have been working toward improving their solid waste management systems. The Phelps County Court, the only court in the Meramec Region to adopt the County Option Dumping Ground Law, has a fulltime sanatarian to see that the law is enforced. Assistance has also been given to private contractors who have tried to establish sanitary landfills to serve the public. For the last ten years, the City of Rolla has been operating a landfill which has always been open to the public. Although the operation of this landfill might not meet the new state regulations, it has been far better than the open dumps it had to compete with. Uniform collection systems are presently in operation in the cities of Newburg and St. James and all the cities have ordinances setting solid waste collection and disposal standards.

More recently, the cities and county are making a joint effort toward establishing a county sanitary landfill. A not-for-profit corporation corporation with the members consisting of the Mayors and the Presiding Judge has been established to serve as the management agency. It was hoped that the landfill board could have a landfill in operation by now, but there have been problems with the Board not being recognized by certain State and Federal Agencies, and there have been difficulties in locating sites for the landfill. Since this is the first time in Missouri that a local governmental corporation will be managing a landfill, every step that is made is breaking new ground. Although it is slow in establishing a good management system, it is felt that it will be worth the wait in economy and quality of operation.

This plan has been written to serve as a guide in making future solid waste management improvements, and to fulfill the planning requirements of Missouri Solid Waste Management Act for Phelps County and the cities of Doolittle, Newburg, Rolla, and St. James.

Background Data-- Population and Housing data from the 1970 Census and MRPC surveys is listed in Table P-1 for Phelps County and the cities in Phelps County.

TABLE P-1: PHELPS COUNTY HOUSING DATA

	Population	Occupied Housing Units	Persons/ Housing Unit	Housing Units w/ 1 Person	Est'd No.of Bus'ns	Industries
Phelps Co.	29,567	8,981	2.9	1,444	---	36
Unincorporated	11,996	3,681	3.2	405	NA	10
Doolittle	509	177	2.9	28	12	1
Newburg	806	260	3.1	63	30	2
Rolla	13,245	3,876	2.8	738	450	18
St. James	2,929	937	2.7	202	182	5

Development of the Plan-- Development of the county solid waste management plan began two years ago when a meeting of the cities and the county was called by the Rolla City Engineer to discuss a combined effort toward establishing a landfill. After several meetings, it was decided to form a County Board to serve as the management agency. Initially it was discussed to expand the duties of the Board to include refuse collection, but since the cities already had collection systems in operation, it was decided that the Board would need only to manage the disposal system.

This plan was then developed by working with the Phelps County Landfill Board for recommendations toward establishing a disposal system, and working with the individual cities and the County toward establishing the collection systems.

Solid Waste Management Recommendations

Management-- Operation of the disposal site will be the responsibility of the Phelps County Landfill Board. Providing collection service in the cities is the responsibility of the city council with each city presently having a staff assigned to supervise the collection operation. Collection service in the unincorporated areas will be regulated by the County Court.

Storage-- Presently, all cities in Phelps County have ordinances in effect which exceed the minimum requirements of the State pertaining to on-site storage of containers. In the future these requirements will continue to be met by the cities. A county court order will be passed regulating the sanitary condition of the storage containers of the people with mailbox collection. These regulations will meet the minimum requirement of the State listed on page 55 of the planning section.

Collection-- The State presently requires that each household, business, and industry in the four cities be provided with refuse collection service. A minimum of once-per-week collection service will be provided with the refuse collection in the cities being regulated by city ordinance and meeting the requirements of the State pertaining to collection systems listed on page 59 of this plan.

Residents of the unincorporated areas of the county will be given three options. The first will be to dispose of their own waste on their own property as long as they meet the requirements of the Missouri Solid Waste Management Act. The second option will be for residents to use one of the bulk containers which will in turn be taken to the county landfill. Since problems are anticipated with accommodating the public at the landfill, it is recommended that a phased development system of placing containers be made. It is recommended that, initially, a container location be around the landfill at St. James. If this is accepted by the public, establishment of a second container location is recommended around Rolla. If both container sites are operating successfully, a third container site is recommended in the Edgar Springs area. The final option given to county residents will be to subscribe to one of the rural mailbox collection systems presently in operation. With refuse collection service available in all areas, a vigorous program of prosecuting persons caught illegally dumping will be initiated.

Promiscuous dumping in the unincorporated areas will be monitored by the County Sanitarian. If it is found that the proposed solid waste management system is not effective in abating promiscuous dumping, alternate methods of providing refuse collection service will be considered.

Disposal-- Disposal of all collected solid waste will be in a State approved Sanitary Landfill. There are presently three landfill sites in abandoned fire claypits that have been inspected and given preliminary approval from the Missouri Geological Survey. Aerial surveys indicate that there are sufficient claypits in the area to last well beyond the ten year period of this plan. The present site of the Newburg City Dump should also be examined for use as a landfill. The detailed Engineering Plan for each site will discuss the waste which will not be allowed to be disposed of at the site. During this study no excessive amounts of special wastes that could not be handled by conventional collection and disposal methods were discovered.

Financing-- All operating costs will be financed through service charges. Capital expenses will be financed through the best methods available.

Long-Range Plans-- As explained in the section on collection, the rural collection system will be constantly monitored for effectiveness by the local officials. If it is found that the existing mailbox collection system is not providing the service the people want, consideration will be given to establishing route areas and letting contracts to service these areas.

Another longrange plan which should be given consideration, is the possibility of developing a thermal energy recovery from Solid Waste Projects in Phelps County. As will be discussed in the following sections, there are many favorable conditions in the Rolla area which could make this a desirable project. It is also recommended that serious consideration be given to the areawide management system discussed in the Planning Section of this report.

Implementation Schedule

July 1974-- Solid Waste Management Plan adopted.

July through January 1975-- All cities will have adopted ordinances regulating refuse collection and disposal. County Court will have adopted a court order regulating the sanitary condition of the refuse collection operation in the unincorporated areas. The County Landfill will be in operation and all dumps will be properly closed.

July 1974 through July 1985-- City and County officials will continue, as they have in the past, to ensure that the solid waste management services the people want and need will be provided at the lowest practical costs.

Solid Waste Management System Design

Introduction-- An extensive study of the City of Rolla's collection system was made by the Rolla Sanitation Department, the City Engineer's Office, and the Regional Planning Commission. During this study, every collection truck was rode, the routes plotted, collection times recorded, and refuse weighed. After this was completed, a study of the collection system budget was made. This information was used in developing a routing analysis and budget for the St. James collection system, which has been operating over one year now, and many of the other collection costs and time projections in the Regional Study. Since the cities of Newburg and Doolittle already have good collection systems in operation, it was felt that time and cost studies would be of little benefit. Typical annual costs and general recommendations for several types of solid waste management systems are in the following sections. These should be used as a guide in considering future improvements.

Rolla Collection System Analysis-- As a result of the collection system study, these recommendations have been made by the Regeional Planning Commission to be considered by the Rolla City Council. They are:

1. A uniform collection ordinance be adopted with the service charge being collected on the Municipal Utility bill.

2. For the crews to work on a four day- forty hour work week. (This recommendation has already been adopted)

3. For the Sanitation Department to try replacing an 18 or 20 cu.yd. compactor truck with a smaller 13 to 16 cu.yd. truck using a two-man crew instead of the three man crew. The main disadvantage of the larger trucks is that their excess weight is destructive to the city streets and alleys. Without dual wheels the 18 cu.yd. packers cannot be fully loaded without exceeding the legal weight restrictions. The smaller trucks also have a lower operating cost and greater maneuverability.

JayCee Wives Public Opinion Survey-- In the spring of 1974 the Rolla JayCee Wives conducted a public opinion survey to determine if citizens of Rolla would participate in a city-wide paper recycling program. A five percent random sample was chosen from the Rolla City Directory then those residents were asked three questions. The first question asked the person being interviewed to list the newspaper he subscribed to. The second question asked, "Would you be willing to save your newspaper and place them outside if someone else would pick them up for you? The third question asked the interviewed person if he thought everyone in Rolla should be required to have trash collection. The results of the first and second questions were analyzed, then compared with records from the newspaper distributors, and it was found the two data sources correlated within 5%. From this data it was computed that the average newspaper generation per household is 17 lbs per dwelling unit per month. Data from the "Treesaver Program" in University City, Missouri indicates that newspaper yield from their recycling program is 24.5 lbs per dwelling unit per month. However, this could be expected since the St. Louis Newspapers are considerably larger than the Rolla Newspaper. Since 86.2% of the people surveyed indicated they would participate in a newspaper recycling program, it is calculated that 28 tons of newspaper could be collected from the City of Rolla each month.

The results of the third question was that 77.6% of those responding felt that everyone in Rolla should be required to have trash collection. A majority of those responding "No" stated that they felt it would be unfair to those on a fixed income. Of course this problem could be eliminated by having a provision for a waiver of fees for anyone on which the service charge would cause an undue hardship.

Municipal Newspaper Recycling Program-- Surveys conducted by Citizens United to Restore the Environment (CURE) indicates that the figures in newspaper generation from the JayCee Wives survey could be conservative. CURE's survey of people using their voluntary recycling center indicate that newspaper generation in Rolla could be as high as 15 tons per week. To accurately determine the newspaper generation in the City, a pilot project of a sample area of the city would probably be necessary.

A typical annual cost of a newspaper collection and recycling program has been developed for the City of Rolla. The cost was developed assuming that two men could collect in a 3/4 ton pick-up truck, bale, and ship all the newspaper voluntarily put at the curbside in the city.

If the CURE generation figures were correct, newspapers would have to be sold for $30/ton F.O.B. Rolla, in order for the recycling program to break even financially. On the other hand if the JayCee Wives figures were correct, the papers would have to be sold for $69/ton F.O.B. Rolla.

TYPICAL ANNUAL COST VOLUNTARY NEWSPAPER RECYCLING PROGRAM

	Initial Cost	Annual Cost
Capital Cost		
3/4 ton pick-up truck *	$ 3,500	$ 877*
Newspaper Bailer *	$ 5,000	$ 1,250*
Personnel Cost		
2 - Collectors - Bailers @ $3.00/hr. plus benefits		$ 15,600
Operating Expenses		
Building Rent - $200 month		$ 2,400
Gasoline--960 hrs/yr x 2 gal/hr. @60¢		$ 1,152
Maintenance		$ 1,000
Insurance		$ 500
Miscellaneous		$ 200
TOTAL ANNUAL COST		$ 22,979

* Annual cost assumes 8% interest on 5 Yr.life

Rural Collection-- The cost of refuse collection in the unincorporated areas of the county varies greatly with the low being $2.50 per month for once per week mailbox service, and the high being $8.00 per month for the same service. Since there is such a a wide difference in the cost of refuse collection it was felt that a routing analysis and typical cost should be prepared. The cost was developed around once-per-week collection of refuse at the users mailbox with a one-man crew using a 13 cu.yd. compactor truck. Most of the routes could be serviced with a ten cubic yd. truck, but the thirteen cubic yd. truck would allow more flexibility in routing, with only a small increase in cost.

Studies of this type of service in neighboring counties indicate that the average time per service is slightly less than one minute, with the average speed on-route being 20 miles per hour and average speed off-route being 40 miles per hour.

Mailbox Collection Routing Analysis-- In the routing analysis, it was assumed that fifty percent of the residents along the routes would subscribe to the service. The routes were designed in a looped pattern, with the loops radiating from Rolla and St. James, to minimize dead hauls. Whenever possible, the routes were designed to take four to five hours to run so they could be serviced in one half of a ten hour day and be in the shop for lunch. Load capacity of the 13 cu.yd. truck was calculated as follows:

2.25 lb/person/day x 3.2 pers/household x 7 days = 50 lbs/household/wk.

13 cu.yd. x 700 lbs/cu.yd. ÷ 50 lbs = 182 households/load

As indicated in Figure P-1 , 13 route areas were found necessary with 50% participation. Table P-2 shows the miles, houses served and estimated time on each route. Routing schedules were developed for an Eastern and Western Crew and are shown on Figures P-2 and P-3 respectively.

TABLE P-2 : PHELPS COUNTY MAILBOX COLLECTION SYSTEM ROUTING ANALYSIS

Area	Miles on Route	Houses on Route	Houses Served	Time Required (hrs)	Crew Assigned
I	45	220	110	5	Western
II	20	291	146	4	Western
III	20	227	114	4	Western
IV	50	272	136	5.5	Eastern
V	40	219	110	4.5	Eastern
VI	40	326	163	5	Eastern
VII	50	270	135	6	Western
VIII	25	257	129	4	Western
IX	30	252	126	5	Western
X	50	342	171	6	Eastern
XI	35	260	130	5	Western
XII	50	235	118	5	Eastern
XIII	50	357	179	7	Eastern
TOTAL			1,767	66 hrs.	

COUNTY ROUTE AREAS

50% PARTICIPATION

Fig. P-1

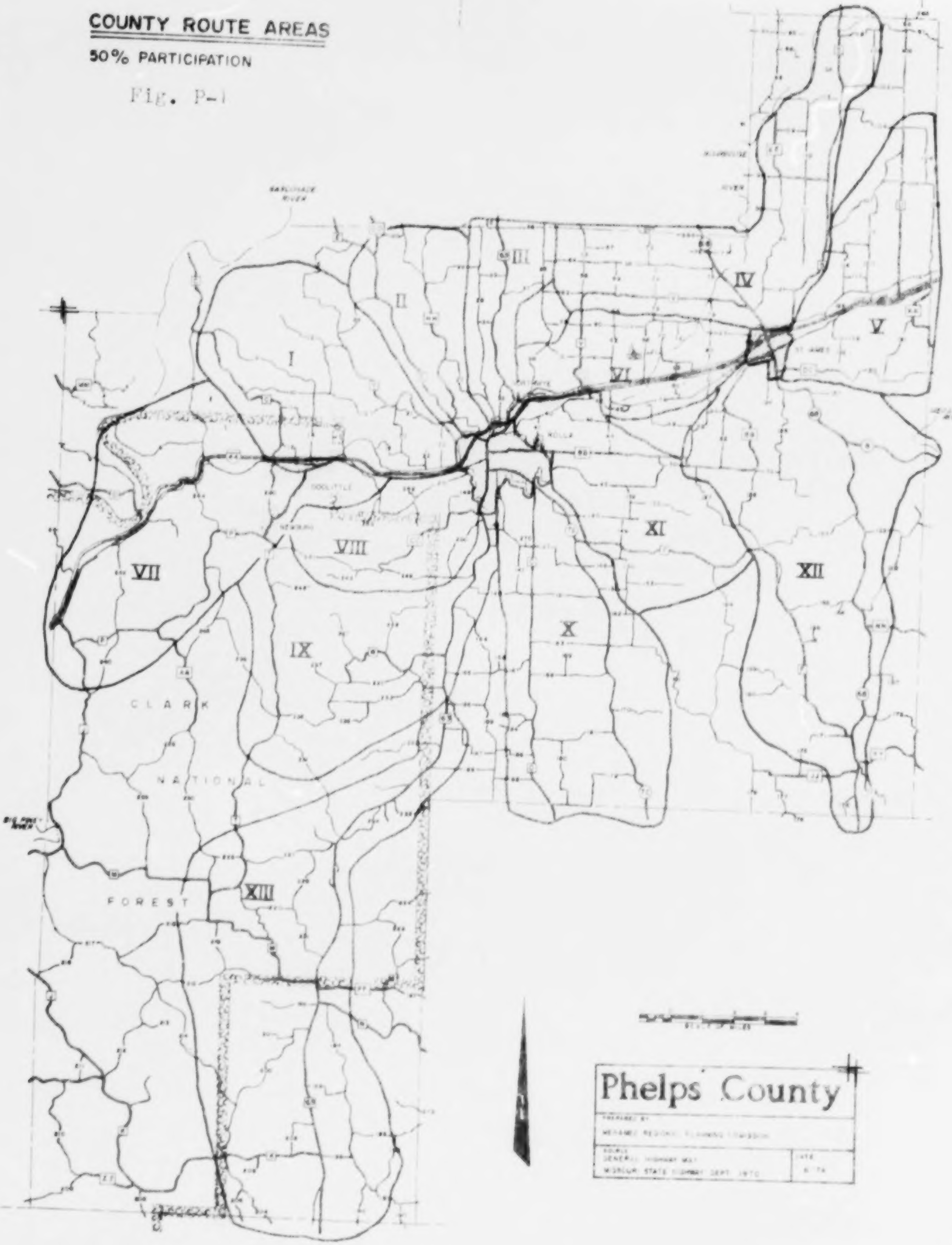
I
II
III
IV
V
VI
VII
VIII
IX
X
XI
XII
XIII
ST JAMES
ROLLA
NEWBURG
DOOLITTLE
CLARK
NATIONAL
FOREST
SCALE OF MILES
Phelps County
PREPARED BY
MERAMEC REGIONAL PLANNING COMMISSION
SOURCE
GENERAL HIGHWAY MAP
MISSOURI STATE HIGHWAY DEPT. 1970
DATE
8-74

Figure P-2

WEEKLY VEHICLE ROUTING SCHEDULE

Eastern Crew

Time / Day	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
6:00 AM							
7:00		Route IV	Route XIII		Route VI	Route X	
8:00							
9:00							
10:00							
11:00			↓		↓	↓	
12:00		↓ Lunch	Lunch		Lunch	Lunch	
1:00 PM		Route V	Route XIII		Route XII	↓	
2:00			↓			Maintenance	
3:00			Maintenance				
4:00							
5:00		↓	↓		↓	↓	
6:00							

Figure P-3

WEEKLY VEHICLE ROUTING SCHEDULE

Western Crew

Time / Day	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
6:00 AM							
7:00			Route I	Route XI		Route IX	Route VII
8:00							
9:00							
10:00							
11:00			↓	↓		↓	↓
12:00			Lunch	Lunch		Lunch	Lunch
1:00 PM			Route II	Route III		Route VIII	↓
2:00							Maintenance
3:00							
4:00			↓	↓		↓	
5:00			Maintenance	Maintenance		Maintenance	↓
6:00							

Typical Annual Cost Mailbox Collection-- Shown below is the typical annual cost developed for the mailbox collection service in Phelps County.

Typical Annual Cost Mailbox Collection

	Initial Cost	Annual Cost
I. Equipment Investments		
2 - 13 cu.yd. Compactor Trucks	$ 30,000	$ 7,515*
II. Personnel		
2 - Drivers - Collectors @$3.50/hr. Adjusted **		$ 18,215
III. Operating Cost		
Gasoline - 3640 hrs x 2.3 gal/hr x 60¢		$ 5,025
Maintenance		
Repair Labor - 50¢/op.hr.		
Repair Parts - 1.00/op.hr.		
Total - $1.50 x 3640 hrs. =		$ 5,460
Uniforms & Safety Equipment		$ 900
Lot Rental ($200/month)		$ 2,400
Insurance		$ 1,000
Miscellaneous		$ 800
Total Annual Cost		$ 41,315

* Annual Cost computed on 5 yr. life at 8% interest.

** Includes Social Security, Hospitalization, Workmans Compensation, Vacation and Sick Leave.

The monthly user cost for refuse collection service is calculated as follows: $ 41,315 ÷ 1,767 users ÷ 12 months = $ 1.95 per family per month.

Mailbox Collection Disposal Cost-- Monthly cost for the disposal of the refuse is calculated as follows: 1.75 lbs/person x 31 day/month x 3.3 persons/household ÷ 2000 lbs/ton x $5.00/ton = 45¢ per family per month.

Mailbox Collection Management and Billing Cost-- An annual cost to cover administrative and billing cost has been developed and is indicated below:

	Annual Cost
I. Administrative Cost	
County Manager (County Court)	$ 1,500
Milage and Expenses	$ 500
Supervisor - $10,000 annual 25% of time	$ 2,500

II. Billing Cost (Quarterly Billing)	ANNUAL COST
Billing Clerk $5000-annual 25% of time	$ 1,250
Building Rent ($200/month) x 25%	$ 600
Mailing Cost @12¢ per bill - 4 per year 1767 x 12¢ x 4 =	$ 850
TOTAL	$ 7,200

The monthly user cost for management and billing expenses are calculated as follows: $7,200 ÷ 1,767 users ÷ 12 months = 35¢ per family per month.

Total Monthly User Cost-- The total monthly user cost assuming 50% participation, was calculated as $ 2.75 per month. With costs increasing as they are, a 20% contingency could be expected. Therefore, the monthly user costs could range between $2.75 to $3.30 per month for once per week mailbox collection service.

Phelps County Landfill Typical Annual Cost-- A typical annual cost has been developed for the operation of the landfill by the Phelps County Landfill Board and is shown on Table 3.

Energy Recovery from Waste-- In this period of shortages of energy and material resources, it is evident that the burying of refuse can be only a temporary solution to the solid waste problem. Although sanitary landfills seem to be an economical solution, the true costs only appear when the unretreviable committments of our natural resources are examined. Reuse of waste material makes good sense, but, to-date there have been no affordable methods of providing a resource recovery system for communities the size of Rolla.

Recent technology in the area of energy recovery by using melted solid waste as a fuel supplement, could provide a long-range, environmentally compatible solution to the solid waste disposal problem. A pilot project conducted jointly by the City of St. Louis and Union Electric to study this process, has been in operation since April 1972. Figure indicates the fuel preparation steps necessary before burning. The process has been successful enough that Union Electric has announced plans to establish transfer stations in the St. Louis area, and expand their refuse burning capabilities. Presently, there have been no indications that this proposal would ever be expanded to include the Rolla area. It would be possible to establish a transfer station in Rolla and transport the refuse to the Union Electric project, then pay a disposal charge. The economic feasibility of such a project would seem doubtful, mainly because of the high transportation cost of shipping a relatively small quantity of waste over 100 miles to St. Louis.

Another project which would take advantage of the high transportation cost would be to develop an energy recovery from waste project using the coal fired boiler at the University of Missouri-Rolla.

Table P-3

PHELPS COUNTY LANDFILL BOARD

Typical Sanitary Landfill Annual Cost

INITIAL EXPENSES	INITIAL COST	ANNUAL COST
955-L Track-type Loader $6.01* x 1820 hrs/yr.	$50,000	$10,938
3" Sump Pump 8% int. - 5 yr. life	$ 1,000	$ 251
Office (Building) 8% int. - 5 yr. life	$ 2,000	$ 501
Chemical Toilet	$ 500	$ 500
Trash Chute-12' x 8' x 20' sheet metal 8% int. - 5 yr. life	$ 1,000	$ 251
Fencing	$ 500	$ 500
Professional Services (Engineering and Legal) 8% int. - 5 yrs.)	$ 5,000	$ 1,253
TOTAL INITIAL EXPENSES	$60,000	$14,194

OPERATING EXPENSES	ANNUAL COST
Equipment Operator - $3.50/hr plus 13% fringe benefits	$ 8,237
Landfill Manager - $3.65/hr plus 13% fringe benefits	$ 8,591
Back-up Man - $3.50/hr 288 hrs.	$ 1,430
Loader Operating Expenses * $6.72 x 1820 hrs/yr	$12,230
Utilities - $60/month	$ 720
Rock & Contract Hauling	$ 2,000
Phone - $20/month	$ 240
Insurance	$ 300
Property Lease	$ 1,000
Accounting & Audit	$ 3,000
Miscellaneous - $50/month	$ 600
TOTAL OPERATING EXPENSES	$38,348
TOTAL ANNUAL COST	$52,542

(*from Table P-3-A)

Table P-3-A

HOURLY OWNING AND OPERATING COSTS

(From Caterpillar Performance Handbook, Edition 4)

Machine Designation . . . . 955-L Track-type Loader

DEPRECIATION VALUE

1. Delivered Price (including attachments) . . $50,000.00
2. (optional) Less Resale Value or Trade-In. . 0
3. Net Value for Depreciation $50,000.00

OWNING COSTS

4. Depreciation: $\frac{\text{Net Depreciation Value (Item 3)}}{\text{Depreciation Period in Hours}}$

$\frac{\text{Value}}{\text{Hours}}$ $\frac{50,000}{12,000}$ . . . . $ 4.16

5. Interest, Insurance, Taxes:
   Annual Rates: Int. 8%, Ins. 3%, Taxes 0 %
   Estimated Annual Use in Hours- 1820-7 hr/day, 260 day/yr.

$\frac{\text{Factor x Delivered Price (Item 1)}}{}$

$\frac{.037 \times 50,000}{1000}$ . . . .$ 1.85

6. TOTAL HOURLY OWNING COSTS. . . . .$ 6.01

OPERATING COSTS

Unit Price x Consumption

7. Fuel: 40¢ x 5.7 . . . .$ 2.28
8. Lubricants, Filters, Grease. . . . .$ .25
9. Repairs: Factor x Del. Price

$\frac{.07 \times 50,000}{1000}$ . . . .$ 3.50

10. Special items:
    Tips (3 @21.00) ÷ 150 hrs = .42
    Shank Protectors (3@40.00) ÷ 450 hrs = .27 .69
11. TOTAL HOURLY OPERATING COSTS . . . .$ 6.72
12. Operator's Hourly Wage . . . .$
13. TOTAL HOURLY OWNING AND OPERATING COSTS. . . . .$ 12.73

In any waste recovery process to serve as a practical solution, the waste disposal problem must be applicable in smaller communities. As can be seen in Figure P-4, if the Energy Recovery from waste process is only practical in communities of over 50,000 population, it will only serve 30% of the people in our Nation.

There are several factors which are working to the advantage of such a project.

The first is that the University is paying over twice as much for coal in Rolla, as they are in St. Louis. There is also a planned expansion of the boiler system which could be readily modified to burn melted refuse as a fuel supplement. The Phelps County Landfill will be reclaiming wasteland by using abandoned fire clay pits as landfill sites. Problems are anticipated, however, in obtaining daily cover, and in operating heavy equipment in the bottom of the deep pits. If the refuse was milled, as would be required for burning, any surplus and the residue could be landfilled with a minimum of compaction and covering.

Proposed cost of operating the Phelps County Landfill indicates that landfill cost in Rolla will equal the cost of milling the refuse at the St. Louis demonstration project. Table P-4 has been developed to show the amount of waste generated and potential heat value in Phelps County.

Figure P-4

FREQUENCY DISTRIBUTION OF PLACES IN THE U.S. WITH

POPULATIONS INDICATED

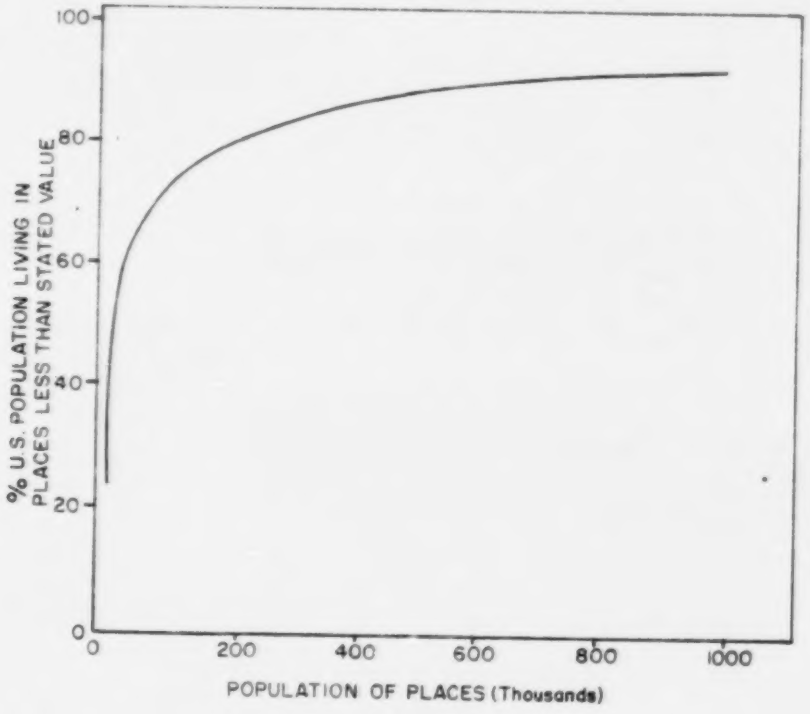

Table P-4

PHELPS COUNTY SOLID WASTE-ENERGY RECOVERY DATA

Area	Daily Solid Waste Quantity *				Ave.Daily Heat Value (in million BTU's)	
	Average (tons)	Seasonal Variation		Ave. Air Classified (tons) **	Unclassified (4560 BTU/lb.)	Air Classified (5017 BTU/lb.)
		min.(tons)	max.(tons)			
Based on a seven day per week operation						
(Doolittle, Newburg, Rolla & St. James)	31.5	27	34	27	287	271
Unincorporated Areas	10.5	8.5	12	9	96	90
Total County	42	35.5	46	36	383	361
Based on a four day per week operation						
Incorporated Area	55	47	59.5	47	502	474
Unincorporated Area	18.5	15	21	16	168	157.5
Total County	73.5	62	80.5	63	670	632

* From Meramec Minimum Sampling Program

** Assumes 15% weight reduction in air classification

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WASHINGTON COUNTY SOLID WASTE MANAGEMENT PLAN

Background

Purpose-- Washington County was found to have the most severe problem with promiscuous dumping in the six-county Meramec Region. Private contractors presently offer voluntary, once-per-week collection in all of the incorporated areas and much of the unincorporated area of the county. However, no matter how economical this collection system is, it cannot compete with the many open dumps on Forest Service and on mining company lands in the county. The high population densities of the unincorporated areas and the low income of many of the residents compound the problem of open dumping. Since the only sanitary landfill in the area is in St. Francous County, the people find the most convenient method of refuse disposal is on the large unattended tracts of land owned by either the U.S. Forest Service or the mining companies. Many of the dumps are in old strip mines which allow percolation into the ground water supply.

Compulsory regulations in the County are not expected to be a very popular subject, but since the present voluntary collection service is having little effect on open dumping, they appear to be the only solution. The purpose of this plan is to outline a method of properly closing the open dumps in the county, then establishing a sanitary economical refuse collection and disposal system to serve all the residents of Washington County. This plan is also intended to meet the planning requirements of the Missouri Solid Waste Management Act of 1972 for the cities of Caledonia, Irondale, Mineral Point, and Potosi, and can be adopted by Washington County to meet their planning requirements.

Background Data-- Population and housing data from the 1970 Census and MRPC Surveys is listed in Table W-1 for Washington County and the Cities in Washington County.

TABLE W-1: WASHINGTON COUNTY HOUSING DATA

	1970 Populations	Occupied Housing Units	Persons/ Housing Unit	Housing Unit w/1 Person	Est.No. of Businesses	Industries
Wash.Co.	15,086	4,530	3.3	712	261	11
Unincorp.	11,524	3,349	3.4	451	59	5
Caledonia	113	45	2.5	14	12	0
Irondale	319	100	3.2	30	19	0
Mineral Pt.	369	104	3.5	16	21	1
Potosi	2,761	932	3.0	201	150	5

Development of the Plan-- The Missouri Solid Waste Management Act will affect both the people living in the incorporated and unincorporated areas of Washington County. Although the city officials are responsible for providing solid waste management services in the incorporated areas, cooperation between the city and county officials is necessary to assure that the most efficient services is provided. In conducting this study it was found that it should not require a full-time collection crew to service even the largest city in the county, which is Potosi. By coordinating planning efforts between the county and cities, service areas can be established which could result in the most efficient routing system for the collector. If the collector can bid on an area servicing both a city and the surrounding unincorporated area, he can plan his route to reduce expensive "dead hauls" through the county. This, in-turn, will reduce the user cost that both the city and county residents must pay for refuse collection service. In the smaller cities like Caledonia and Mineral Point a coordinated effort is most critical to assure a good bid for service.

City officials have expressed a desire to meet with the County Court to discuss jointly working toward a solution to the solid waste problem. The County Court, however, does not feel they should be burdened with the responsibility of working with the city officials, even though the city residents equally elect and pay taxes to the County Court. It is hoped that the County and City officials can work together toward establishing the most economical solid waste management system for the citizens of Washington County.

Solid Waste Management Recommendations

Management-- All refuse collection and disposal operations will be by contract with private contractors. The respective City councils will be responsible for supervising the contractor in the incorporated areas and the County Court will be responsible for all contracts in the unincorporated areas. Letting of all contracts should be coordinated between city and county officials.

Storage-- On-site storage of solid waste will be regulated by city ordinance in the incorporated areas and county court orders in the unincorporated areas. The ordinances and court orders will be developed to meet the sanitary requirements of State law as stated on page 55 of this report.

Collection-- As required by State law, every household, business, and industry in the cities of Irondale and Potosi will be required to have refuse collection service. A minimum of once-per-week, curb-side collection of refuse will be required. Since the cities of Caledonia and Mineral Point have no utility billing system, it is felt that the only practical method of collecting refuse service charges would be to combine with the county system that is developed. Refuse Collection in all unincorporated areas will be regulated by city ordinance which will meet the State requirements previously mentioned on page 59 of this report.

The Washington County Court has expressed an interest in establishing a county containerized system for use by the county residents. This could provide a very good refuse collection service, but, problems are anticipated with locating container sites for all the containers that would be required. The State Highway Department has been extremely hesitant to allow bulk containers to be placcd on State right-of-ways. This would mean that all containers would have to be placed on county roads or private property such as, church, gorcery store or gas station parking lots. Since mailbox collection routes are already established in many areas of the County, some residents might object to lowering the level of service to a bulk container system.

It is recommended that the County Court consider a combined system of both centrally located containers and mailbox collection service as outlined in the following sections of this plan. Whichever alternative is chosen, the County Court will ensure that every resident of the unincorporated area has a state approved method of disposing of his refuse without on on-site dumping charge. Operation of the collection system in the unincorporated areas will be regulated by County Court Order which will meet the sanitary requirements of the State that are listed on page 59 of this report.

Disposal-- Disposal of all solid waste will be in a State approved sanitary landfill. Residents of Washington County are fortunate that there are two landfills being operated very close to their border. One is at Sullivan and one is in St. Francois County near Elvins. It is felt that disposal of all solid waste should be in one of these two landfills. Serious consideration should be given to the cities and county contracting for disposal with the landfill management authorities, rather than their contractor, since this might result in a lower user charge to the customers.

The County dump must be closed to meet State requirements and the County should urge that all promiscuous dumps on private property be properly closed. Information on how to properly close open dumps is available from the Missouri Department of Natural Resources.

Financing-- Financing for solid waste management services can be by a combination of a service charge and the revenue from the Solid Waste Tax, or entirely from a service charge. If the voters approve of the 10¢ per $100 assessed evaluation solid waste levy, the revenue would pay for the disposal of all waste from the cities, then the customer would only have to pay for the collection and administrative cost. This would probably mean little increase in the user charge the people are now paying. If the cities and county decide not to place the tax on the ballot or if the tax would fail to be passed, a service charge must be used to pay for all solid waste management operation costs. Financing of capital expenses will be the responsibility of the contractor.

Future Plans-- As contracts come due, alternate methods of providing more efficient, economical refuse collection and disposal service will be examined. The effectiveness of the established solid waste management system in abating open dumping will be monitored by County and City officials. If it is found that the system does not eliminate open dumping, appropriate action will be taken.

Implementation Schedule

July 1974-- Solid Waste Management Plan adopted.

July 1974 through January 1975-- The Cities of Irondale and Potosi will have adopted the previously mentioned ordinances regulating refuse collection and disposal.

July 1974 through June 1975-- The county collection system and collection systems in the Cities of Caledonia and Mineral Point will be in operation. The county dump will be properly closed.

Solid Waste Management System Design

Introduction-- To provide city and county officials with an estimate of what the various types of refuse service will cost, routing analyses and typical annual costs were developed for the different types of service. These cost projections should be used as a guide when examining the contractors bid.

Cost Summary-- Table W-2 is a summary of the projected user cost.

TABLE W-2: PROJECTED MONTHLY USER COST

	Collection	Disposal	Administration	Contingency	Total Cost Range
County Containerized	$ 1.14	.30	.16	.32	$1.60-$1.92
Central Containers	$ .81	.30	.16	.26	$1.27-$1.55
Mailbox Collection	$ 2.02	.30	.27	.35	$2.65-$3.25
City Coll. Residential- (1 per week)	$ 1.49	.28	.27	.40	$2.00-$2.45

Municipal Design Data-- Table W-3 is a summary of the routing analysis for once per week curbside collection service for the cities in Washington County. The estimated collection time is based on .75 minutes per curbside stop and 2 minutes per commercial container, with the refuse being hauled to the St. Francois County landfill. The analysis assumes a 13 cu.yd. compactor truck will be used with compaction density of 700 lbs. per cubic yard. Estimates of the average time per stop and refuse generation rates are from studies of similar collection systems in the area.

TABLE W-3

ROUTING ANALYSIS SUMMARY FOR CALEDONIA, IRONDALE, MINERAL POINT AND POTOSI REFUSE COLLECTION SYSTEM

	Caledonia	Irondale	Mineral Point	Potosi	Total
Avg.Refuse/week					
Residential (lbs)	1,400	3,900	4,600	33,800	43,700
Commercial (lbs)	1,300	3,700	4,300	31,900	41,200
Industrial (lbs)				10,000	10,000
TOTAL (lbs)	2,700	7,600	8,900	75,700	94,900
Annual Generation (tons)	70	198	232	1970	2,470
Loads Per Week	.4	1	1.2	10.4	
Est. Collection Time					
Curbside (hrs)	1.2	2.5	3	24	30.7
Containers (hrs)				1	1
TOTAL (hrs)				25	31.7
Maintenance Time (hrs)					5
TOTAL TIME REQUIRED					36.7 hrs.

Typical Annual Cost of a Municipal Collection Route-- The typical annual cost for a collection crew to serve Caledonia, Irondale, Mineral Point and Potosi is shown on the following page.

TYPICAL ANNUAL COST FOR MUNICIPAL COLLECTION ROUTE

I. Equipment Investments	Initial Cost	Annual Cost
13 cu.yd. Compactor Truck (w/overhead wench & C.B. Radio)	$ 15,000	$ 3,757*
II. Personnel		
Driver - $3.50/hr. adjusted**		$ 9,107
Collector - $3.00/hr. adjusted**		$ 7,800
		$ 20,664
III. Operating Expenses		
Gasoline - 1820 hrs. x 2.3 gal/hr @60¢ per gallon		$ 2,512
Oil - 1820 hrs @ .04 qt/hr @ 35¢/qt		$ 26
Parts and Repairs Repair - labor - 50¢/operating hr. Repair - parts - $1.00/operating hr. $1.50 per operating hr x 1820 hrs. =		$ 2,730
Uniforms (10 per week)		$ 400
Equipment lot rental ($100/month)		$ 1,200
Insurance		$ 400
Miscellaneous		$ 400
Subtotal		$ 7,668
Annual Cost		$ 28,332

* Annual cost computed on 5 yr. life @ 8% interest

**Adjusted salary includes Soc.Sec., Hospitalization, Unemployment Insurance, Vacation and Sick Leave

Monthly Collection User Cost-- Cost allocated to municipal curbside collection is computed as follows: 35.7 hrs. per wk. ÷ 40 hrs. per crew per wk. x $27,663 = $24,690. Monthly collection service charge: $24,690 ÷ 12 months ÷ 1383 services = $1.49/household/mo.

Monthly Disposal User Cost-- Percentage allocated to Residential- 43,700 lbs ÷ 94,900 lbs = 46¢. 2,470 tons x $3.50/ton x .46 ÷ 12 ÷ 118/residential services = 28¢.

Administrative Cost-- Administrative costs are the costs incurred by the city for supervision of the contractor and for billing for the refuse collection service. A typical cost for this service for a system with 1000 billings is shown below to indicate what a reasonable months user cost might be.

Municipal Collection System Administrative Cost

	Annual Cost
Administrative Cost	
City Administrator	$ 1,000
Mileage, Phone, etc.	$ 250
Billing Cost	
Billing Clerk - $4,000 annual plus personnel burden - 25% of time	$ 1,250
Mailing - 1000 bills x 12 months x 10¢ x .25	$ 300
Miscellaneous Supplies	$ 400
TOTAL	$ 3,200

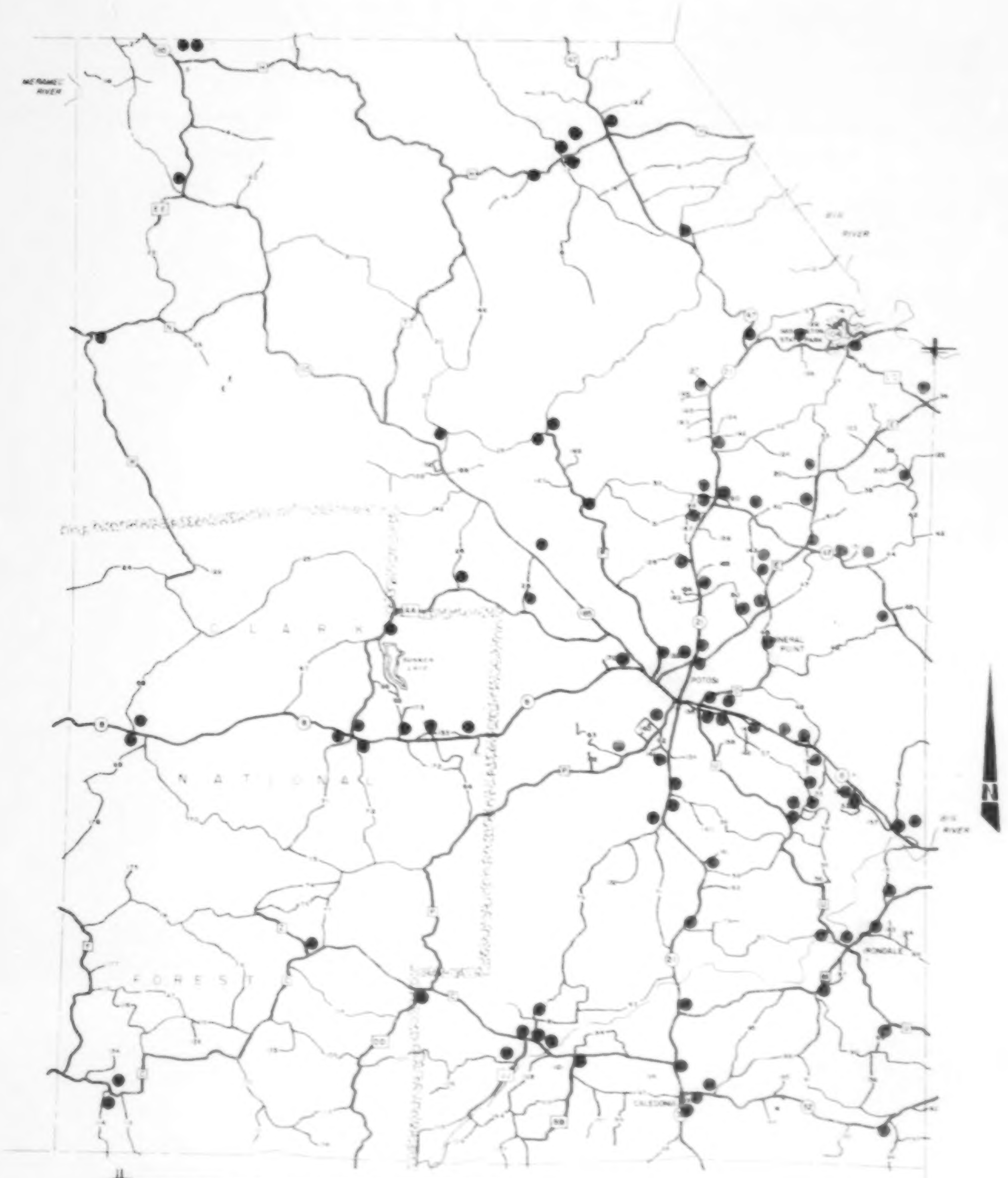
Monthly Service Charge
$3200 ÷ 12 ÷ 1000 = 27¢

County Containerized System-- To provide county officials with an estimate of the user cost for a countywide bulk container refuse collection system a container location survey, routing analysis, and typical annual cost was developed by Leonard Johnson with the University of Missouri-Extension and the M.R.P.C. staff. Assuming 1.5 lbs/per day refuse generation, twice-per-week service, 200 lb/cu.yd. density and containers serviced when 80% full it was calculated that 110-four cubic yard containers would be needed. Figure W-1 indicates the approximate locations of the containers which should provide good service to the residents and allow for economical collection routes to be established. Problems are to be anticipated in obtaining all the container sites which will be required. It is recommended that whenever possible containers be located on parking lots of places such as stores, gas stations, churches or parks to reduce site development cost.

County Containerized System Routing Analysis-- Since there are many low weight limit bridges in Washington County a 13 cu.yd. truck was selected to service the containers. Figure W-2 indicates the route areas which were established and Table W-4 shows the estimated time to service these areas. Refuse from Routes I through VIII is proposed to be taken to the St. Francois County landfill and the refuse from Route IX is to be taken to the landfill at Sullivan.

BULK CONTAINER LOCATIONS

Fig. 1


MERAMEC RIVER
BIG RIVER
CLARK
NATIONAL
FOREST
POTOSI
MINERAL POINT
IRONDALE
CALEDONIA
N

Washington County

PREPARED BY
MERAMEC REGIONAL PLANNING COMMISSION

SOURCE
GENERAL HIGHWAY MAP
MISSOURI STATE HIGHWAY DEPARTMENT [illegible]

DATE
[illegible]

COUNTY CONTAINERIZED ROUTE AREAS

Fig. W-2

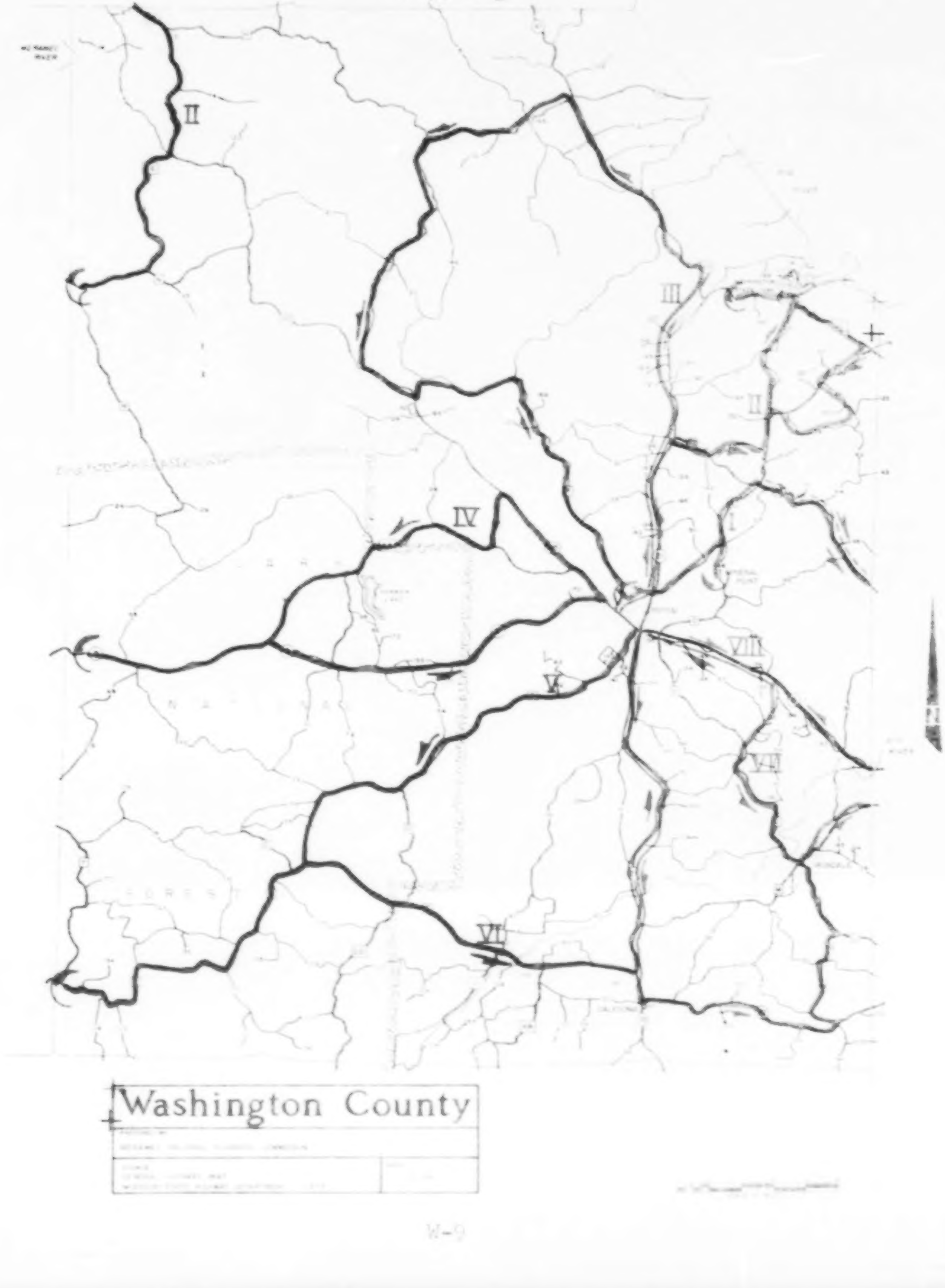

II
III
II
IV
I
VII
V
VI
VI
Washington County

TABLE W-4

CONTAINERIZED COLLECTION ROUTE SERVICE TIME

Route	Containers Served	Estimated Time
I	13	2.5 hours
II	13	2.5 hours
III	13	3.5 hours
IV	13	3 hours
V	13	3.5 hours
VI	13	3 hours
VII	13	2.5 hours
VIII	12	2 hours
IX	4	2.5 hours
		25 hours
	Weekly Service Time . . .	50 hours/week
	Maintenance	5 hours/week
	Total Weekly Time Required	55 hours/week

Typical Annual Cost for County Containerized System

Equipment Investments	Initial Cost	Annual Cost
13 cu.yd. compactor truck* (w/overhead wench, radio, and pressure cleaning unit)	$ 15,000	$ 3,757
Containers** 120 - 4 cu.yd. @ $300 ea.	$ 36,000	$ 11,570
Personnel		
Driver - Collector ($3.50/hr) (plus Soc.Sec., hospitalization, unemployment, vacation and sick leave)		$ 9,107
Site Preparation - 110 @ $250	$ 27,500	$ 6,890
Operating Expenses		
Gasoline - 1820 hrs x 2.3 gal/hr @ 60¢ per gal.		$ 2,512
Oil - 1820 hrs @ .04 qt/hr @ 70¢/qt.		$ 44
Parts and Repairs a. Repair-labor 50¢ per op. hr. b. Repairs-parts $1.00 per op. hr. Total =$1.50/hr. x 1820 hrs. @$1.50 =		$ 2,730
Uniforms (5 per wk)		$ 200
Lot Rental - $100/month		$ 1,200
Insurance		$ 400
TOTAL (Less Containers & Site Preparation)		$ 19,950

*Annual Cost computed on 5 yr. life @ 8% interest
**Annual Cost computed on 3 yr. life @ 8% interest

Monthly Collection User Cost-- The collection user costs are calculated as follows: 55 hrs. ÷ 40 hrs/crew = 1.4 crew required. $19,950 x 1.4 ÷ 12 months ÷ 3408 services = 69¢. Container rental-$18,460 ÷ 12 months ÷ 3408 services = 45¢.
Monthly collection costs = $ 1.14

Monthly Disposal Cost-- The disposal costs are calculated as follows: 1.5 lb/day x 11,524 persons x 365 days ÷ 2000 lbs/ton x $3.50/ton ÷ 12 months ÷ 3408 services = 30¢.

Administrative Cost-- The same as with a municipal solid waste management system the cost of providing management service and handling the billing should be reflected in the service charge. A typical annual cost is shown below:

MANAGEMENT AND BILLING

Typical Annual Cost

(Semi-Annual Billing)

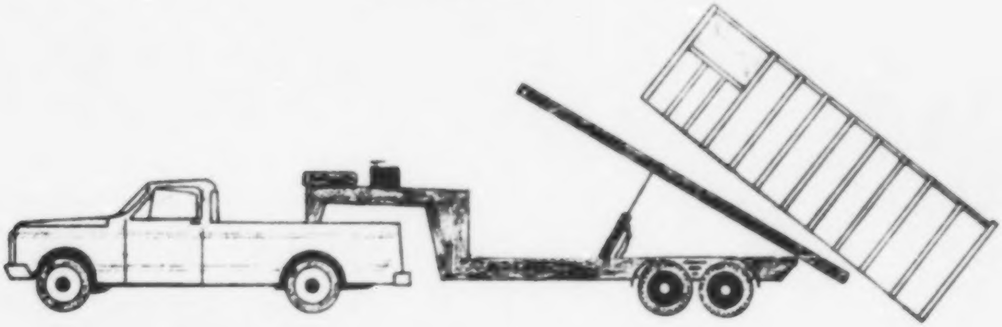
	Annual Cost
Administrative Cost	
County Administrator	$ 2,000
Mileage, Phone, etc.	$ 500
Billing Cost	
Billing Clerk - $4,000 Annual-50% of time . . .	$ 2,000
Mailing - 2917 x 8¢ x 2.	$ 467
Miscellaneous Supplies	$ 200
Professional Services (Legal, Engineering, etc). .	$ 1,400
TOTAL	$ 6,567

Monthly User Service Charge
$6567 ÷ 12 months ÷ 3908 = 16¢ per month

Mailbox Collection System-- Another alternative which would allow county residents to select the level of service they desired would be to combine a centrally located bulk container system with a voluntary mailbox collection system. The bulk containers would be located at several places in the County for residents to bring their refuse to. Anyone wanting a higher level of service could have their trash picked-up at their mailbox.

Goose-Neck Roll-Off Container System-- This refuse collection system is composed of large bulk containers located at several sites throughout the county. The containers have a compaction unit which requires electrical power, therefore they must be placed at a service station or store where electricity is available. Also available must be an attendant to occasionally compact the load. The containers are serviced by bringing in an empty container on a goose-neck trailer that is pulled by a pick-up truck, as shown in Figure W-3. The full container is then loaded on the trailer and taken to a landfill, then being emptied, the container is taken on to the next site. One advantage to this system is the small amount of equipment required to begin operation.

Figure W-3



Container Sizing-- It will be assumed that everyone in the county will participate in this system. The container size required is caluclated as follows:

5762 persons x 1.5#/person/day x 4 day (max. collection period)=
34,572 lbs. of trash per collection period.
12 cu.yd. container size x 700 lbs/cu.yd. = 8,400 lbs/container
39,572 ÷ 8,400 = 4 containers required plus one spare unit.

Container Collection Routing-- Four container site locations were assumed as shown in Figure W-4, with a routing system to service the containers developed and test driven. As a result, it was found that all the containers should be able to be serviced in one day.

ROLL-OFF CONTAINER SYSTEM

Typical Annual Cost

Capital Cost	Initial Cost	Annual Cost
3/4 ton pick-up truck*	$ 3,500	$ 877
5 - Roll-Off Containers @$4,200 ea.*	$ 21,000	$ 5,260
1 - Roll-Off Flatbed Hauler **	$ 5,200	$ 2,018
Personnel Cost		
Driver - Loader @$3.50/hr (adjusted 20 hrs.wk.)		$ 4,553
Operating Expenses		
Gasoline - 23,400 mi/yr @12 mi/gal & 50¢/gal.		$ 975
Oil		$ 25
Pick-Up Truck Maintenance 5¢/mi.		$ 1,000
Container Maintenance - $20/cont./mo.		$ 960
Insurance		$ 600
Miscellaneous		$ 200
TOTAL	.	$16,468

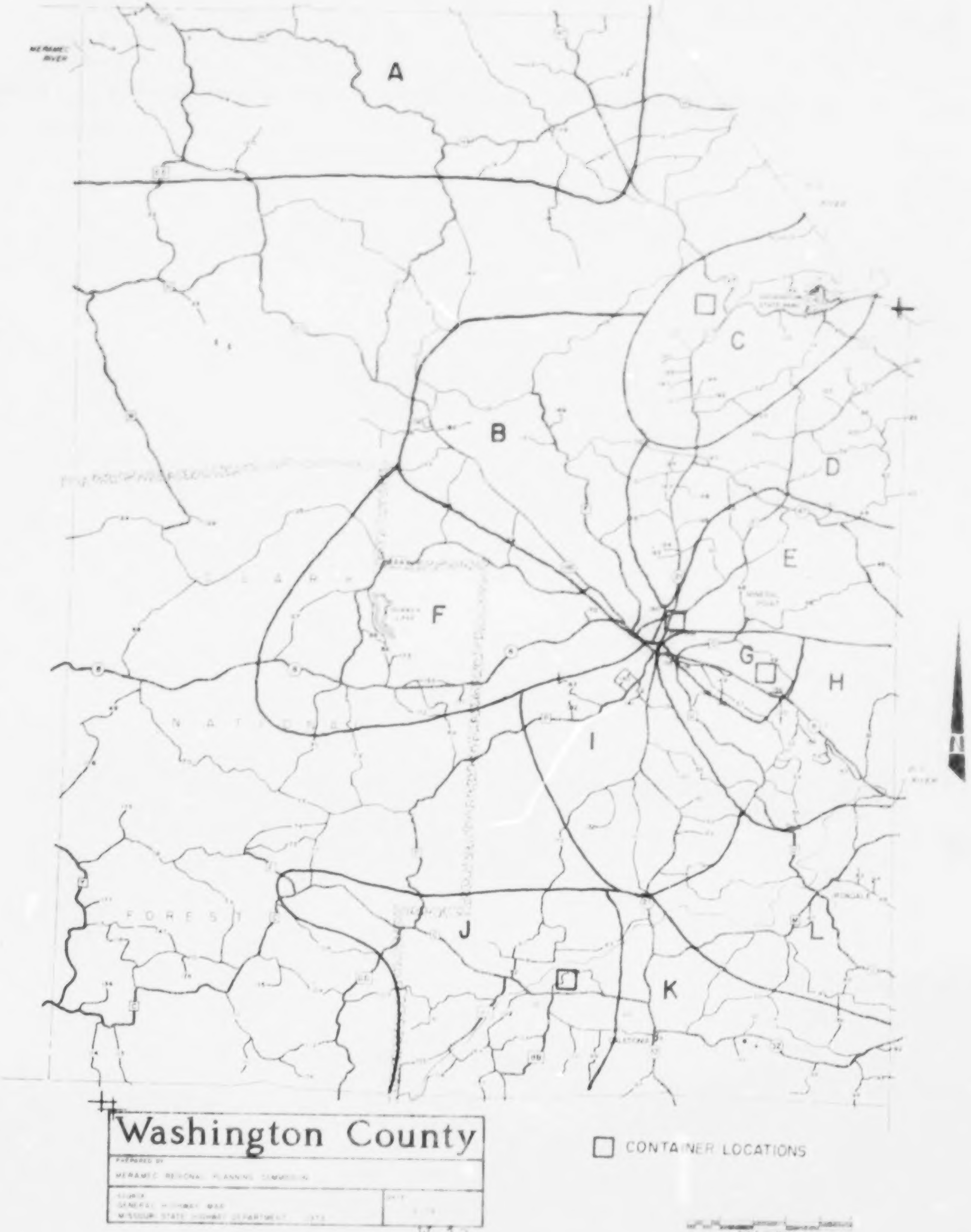
Annual Landfill Cost

Solid Waste Generation
5762 persons x 1.5 #/person/day x 365 days
÷ 2000 = 1577 tons/yr.
Disposal Cost = 1577 x $3.50/ton = $5,520/yr.
Total Annual Collection & Disposal Cost = 21,988
User Cost for Collection and Disposal = 21,988/12 mo/1704 users =
$1.08/user/mo.

* Annual Cost based on 8% interest-5 yr. life
**Annual Cost based on 8% interest-3 yr. life

MAILBOX COLLECTION ROUTE AREAS AND CONTAINER LOCATIONS

Fig. W-4


MERAMEC RIVER
A
B
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L
Washington County
PREPARED BY
MERAMEC REGIONAL PLANNING COMMISSION
SOURCE
GENERAL HIGHWAY MAP
MISSOURI STATE HIGHWAY DEPARTMENT
DATE
☐ CONTAINER LOCATIONS

Mailbox Collection System Design Data-- Voluntary refuse collection is available in many of the subdivisions and mobile home courts in the unincorporated areas of the County. However, with the implementation of the alternative of the County Solid Waste Management Plan, the mailbox collection system would be greatly expanded. In order to get an idea of what an acceptable service charge might be a routing system design and typical annual cost was prepared. Very little design data could be found for rural mailbox collection systems, so the data had to be developed first hand. Time studies were run on existing rural collection systems in the Region and it was found that the most efficient system was a one-man crew operating a small 10 to 13 cu.yd. truck. For this type of system the average time per stop was found to be slightly less than one minute, with the average speed on route being 20 m.p.h. and average speed off route being 40 m.p.h. It was assumed that 50% of the residents in the unincorporated areas would subscribe to the service.

Mailbox Collection Routing Analysis-- As indicated in Figure W-7 twelve route areas were found necessary to serve the unincorporated area of the county. Time projections indicate that it should take close to the full time of two crews to service the twelve areas.

Typical Annual Cost Mailbox Collection-- Shown below is the typical annual cost developed for the mailbox collection service in Washington County.

Typical Annual Cost Mailbox Collection

	Initial Cost	Annual Cost
I. Equipment Investments		
2 - 13 cu.yd. Compactor Trucks	$ 30,000	$ 7,515*
II. Personnel		
2 - Drivers - Collectors @$3.50/hr. (adjusted)**		$ 18,215
III. Operating Cost		
Gasoline - 3640 hrs x 2.3 hal/hr x 60¢		$ 5,025
Maintenance		
Repair Labor - 50¢/op.hr.		
Repair Parts - $1.00/op.hr.		
Total - $1.50 x 3640 hrs. =		$ 5,460
Uniforms & Safety Equipment		$ 900
Lot Rental ($200/month)		$ 2,400
Insurance		$ 1,000
Miscellaneous		$ 800
Total Annual Cost		$ 41,315

*Annual Cost computed on 5 yr. life at 8% interest

**Includes Soc. Sec., Hospitalization, Workmans Compensation, Vacation and Sick Leave.

The monthly user cost for refuse collection service is calculated as follows: $41,315 ÷ 1704 users ÷ 12 months = $2.02 per family per month.

Mailbox Collection Disposal Cost-- Monthly cost for the disposal of the refuse is calculated as follows: 1.75 lbs/person x 31 days/month x 3.4 persons/household ÷ 2000 lbs/ton x $3.50/ton = 30¢ per family per month.

Mailbox Collection Management and Billing Cost-- An annual cost to cover administrative and billing cost has been developed and is indicated below:

	Annual Cost
I. Administrative Cost	
County Manager (County Court)	$ 1,500
Mileage and Expenses	$ 500
Supervisor - $10,000 annual (25% of time)	$ 2,500
II. Billing Cost (Quarterly Billing)	
Billing Clerk $5000 annual (25% of time)	$ 1,250
Building Rent ($200/month) x 25%	$ 600
Mailing Cost @12¢ per bill - 4 per year 1767 x 12¢ x 4 =	$ 850
	$ 7,200

The monthly user cost for management and billing expenses are calculated as follows: $7,200 ÷ 1,704 users ÷ 12 months = 35¢ per family per month.

Total Monthly User Cost-- The total monthly user cost assuming 50% participation, was calculated as $2.67 per month. With costs increasing as they are, a 20% contingency could be expected. Therefore, the monthly user costs could range between $2.67 to $3.25 per month for once per week mailbox collection service.